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Roosevelt Outsmiths Smith

GOVERNOR ROOSEVELT'S eagerly awaited plan for water-power development in New York was presented to the Legislature last week. Instead of a state-wide program, the Governor confined himself to the development of the St. Lawrence, an international stream the rights of the State of New York over whose water have not as yet been passed on by the Supreme Court. However, regardless of that, Governor Roosevelt's ideas on water-power development are such as to invite defeat at the hands of the Legislature and to deprive him of support elsewhere. Private capital would gladly aid in developing New York's natural resources, but hardly under the terms the Governor proposes. His plan shuts the door to private initiative and enterprise and sounds its own death knell.

An instrumentality of the state, "the trustees of the water-power resources on the St. Lawrence River," would control the rates instead of the Public Service Commission, also a creature of the state; but why one should be more competent than the other is difficult to say. Moreover, rates will be based on actual cash outlay and fixed on a contract basis, notwithstanding that the dollar is far from stable. Surely, Governor Roosevelt is not gullible enough to believe that any one would care to invest money under such conditions in such a project even if it were state-owned. In collecting taxes the State of New York does not concern itself with the actual cash paid for property. Nor, in fact, should it. Any attempt, therefore, to foist such a system of valuation on either state-owned or privately owned water-power property deserves to be defeated. Governor Smith's proposals were erratic enough, but Governor Roosevelt's are worse.

* * * *

New Apparatus for Old

PROGRESS often comes about in cycles whereby a multitude of small developments culminate in revolutionary changes in a short period of time. Indications are rather numerous that electrical power apparatus has reached such a stage, and the near future is likely to bring about a complete rebuilding of many equipments that have been accepted as fixed in material, form and design. The change may not be so complete or so sudden as that brought about by the replacement of the engine by the turbine, but evidence is available that a transition period is at hand.

New principles, new materials, new methods and new requirements to be met have brought about successive stages of development in all parts of the power system. Step by step the boiler and turbine have changed from their original forms until contemplated installations differ from the older ones as day does from night. In generators and motors the use of new steels and iron, of welding fabrication methods, of inclosed ventilation with gas-cooling mediums and of new insulations promise very radical changes in design practice. The advent of inclosed metal-clad switchgear and the new developments in oil and air circuit-breaker theory promise to bring about revolutionary changes in the design and use of high- and low-tension switchgear and the assemblies of connections. Even lamps, small motors and other devices are undergoing changes in material and design that will greatly improve their efficiency and performance.

Standardization does not attempt to handicap the use of cheaper and better apparatus and methods. The electrical industry has always stood for progress and improvement despite the temporary trials and costs involved in making changes from the old to the new. It will meet the anticipated revolutionary changes in equipment with courage and vision.

* * * *

Editors View the South

FIFTEEN editors representing McGraw-Hill papers, including, of course, the Electrical World, have just returned from a tour of seven Southeastern States, where in sixteen or more cities industrial activities and possibilities have been studied. Their impressions are still in a kaleidoscopic state, but certain observations may be made with complete confidence.

Industrial development of the South is no myth. It was evident in every section visited. The developments are not confined to cotton, tobacco, sugar and other agricultural products commonly associated with the South. Diversification is already well established, and still further variety may be expected if the spirit of the New South has its way. In a number of cities industrial commissions or committees are working on a strictly engineering basis, analyzing the nature and magnitude of local resources and local consumption of products in order that new industries may determine the desirability of locating there. A sincere effort to base these invitations to industry on facts and not propaganda is evident.

Already a trend is observable which any growing industrial region may profitably emulate. That is to locate new industrial plants in such physical relation with one another that the products of each can be used by the others with the least transportation. For example, chemical plants are piping their major products or their byproducts to neighbors and in turn purchasing the output of adjacent plants. Wood refuse from one plant is distilled next door by another plant for its valuable chemical products. In another case a large book-publishing house utilizes a portion of the output of an adjacent paper mill. And so the story goes.

Starting from "scratch," so to speak, new industries have been able to profit from the lessons learned in older industrial sections in planning their organizations, selecting and arranging equipment, housing labor, and so on. From the engineering viewpoint this release from precedent or the fetters of an investment in existing equipment is particularly valuable because the industries which are being established in the Southland are, in general, employing the latest equipment and arrangements of apparatus.

It is greatly to the credit of the electric utilities which have built the wide-flung power network of the Southeast, and even some of those isolated from it, that they have planned ahead and are in excellent condition to serve new industries which may locate in their territory.

Considering the Southeast as a whole, however—and this comment may apply to other sections of the United States—it does seem that more effective results could be produced in industrial development if there were regional co-ordination of effort and less intercity competition. A certain amount of competition should remain as an incentive or stimulus, but any section with related interests should be supported by all of its constituents and the advantage of the individual cities made subordinate to regional advantage. Working separately on the collection of statistics regarding natural resources and consumption of products, individual cities may duplicate one another's efforts and increase their development expense. At least, the activities in each state might be coordinated more, and possibly a certain amount of regional co-ordination would be desirable. In this work utility companies can assist considerably.

* * * *

Station and Industrial Line-Start Motors

IN RECENT years the demand for line-start motors has become quite widespread, and the manufacturers are confronting the rather difficult problem of designing these motors to meet various and in some cases unreasonable requirements, as was brought out in papers presented at the midwinter convention of the American Institute of Electrical Engineers. It may not be amiss at this time to call attention to the fact that the requirements for industrial plants on one hand and steam plant auxiliaries on the other are not the same. In industrial plants there is often a desire to eliminate only the compensator, since it is very seldom desirable and is often hazardous to allow a piece of equipment to start automatically after the motor is stopped by low voltage. In such plants, therefore, even line-start motors are generally equipped with undervoltage trips. Moreover, the motor efficiency and power factor are important matters, and the public utility objects to excessive starting currents.

With motors on steam-plant auxiliaries, however, the one and most important consideration is continuity of service. Auxiliaries must not stop under any conditions, and after a dip in voltage all motors must come back automatically. On variable-speed fan motors it is important in many cases, such as when automatic combustion control is employed, not to allow the motor to trip on low voltage, and motors must come back automatically at any position of the controller. In these applications, while the elimination of the compensator represents a very desirable simplification, the main object is to get rid of the low-voltage trip. A good power factor, high efficiency and low starting current are all very desirable, even for station auxiliaries, but they are of much less importance in a large power house than in an industrial plant. For station auxiliary service it is of the utmost importance to have motors that are simple in design, mechanically strong enough to stand a great deal of abuse, that will start easily, run always, never trip, and automatically and quickly pick up the load after a dip in voltage. For industrial service it may be necessary to define the use of line-start motors in terms of the capacity of the service, the transformer bank or the connected load on the service.

* * * *

Control of Surplus Power in Maine

SURPLUS hydro-electric power exportation by modification of the Fernald law is a major issue before the Maine Legislature. The principal operating companies favor Senator Carlton's bill, under which transmission companies would have the right to purchase and sell energy outside the state on approval of the Maine Public Utilities Commission, which would determine the available surplus and certify it for export after the reasonable needs of the Maine market were supplied. The bill closely resembles the Smith bill of two years ago, which was vetoed by former Governor Brewster, and carries a referendum to next fall's election. Very little new material on this long-debated question was brought out at recent joint committee hearings in Augusta, but the opposition to exportation of surplus power appears weaker than at any previous time.

Stripping the political wrappings from the problem, it appears that honest opposition to such exportation is based on the fear that if bulk energy shipment into New Hampshire and Massachusetts begins, the control of the federal government over the transaction will threaten if not invalidate Maine's jurisdiction. It is a source of anxiety to not a few citizens of the Pine Tree State that if export becomes established on the basis of power contracts of sufficient duration to attract the signatures of outside buyers, the time may come when Maine will be unable to fill her own proper requirements. These people are afraid that state regulation of surplus power delivery will be destroyed by federal jurisdiction over interstate commerce and that the reallocation of hydro-electric power from Maine plants for the Maine market may become a legal impossibility.

Even if such recall were to prove impossible, it by no means follows that Maine would be worse off. There are two reasons for this. In the first place, the increased taxation inseparable from the expenditure of scores of millions of dollars in hydro-electric construction, assured if exportation is permitted, would be a most important addition to the state's revenue. Second, the over-all cost of power production in steam plants at tidewater is so low today that the power market of Maine need not suffer material shortage because of hydro power export on the south and west. Some economic readjustment might be necessary, it is true, between the seaboard and interior power markets; but the benefits of selling large blocks of power produced in Maine to outside buyers on mutually profitable terms would be so great as largely to offset the supposed economies of keeping all but surplus power at home.

Counsel for the Central Maine Power Company vigorously argued that under the constitution of the United States there is no way by which the federal government could reach behind the point of delivery and compel the continuance of sale against the rulings of the Maine commission. They point out that the highest court has distinctly held that a corporation has only such powers as are given it by its creating charter and maintain that the transmission companies to be created under the Carlton bill would only have power to buy excess energy for extrastate sale.

West Virginia settled the same issue this month, after several years of dispute, by passing an act which agrees with the provisions of the Carlton bill. Maine would do well to take advantage of the present economic opportunities under the safeguards proposed.

* * * *

Curling Irons and Bobbed Hair

WHAT busy, imaginative man would seek reading matter more fascinating and more thought-provoking than a census bulletin? Sparing of phrase, eloquent in its conciseness, picturing far-reaching social changes, registering the tides of the ocean of business in the most exact language, numbers; sustaining interest, as do other thrillers, by serial publication!

"Curling irons—1927: Number, 1,355,615; value, $984,496. 1925: Number, 1,534,786; value, $1,703,088." Taken almost at random from an apparently uninspiring multigraphed sheet headed "Department of Commerce, Census of Manufactures, 1927," here is a whole story in a line of type—a nation's housekeeping epitomized in a page.

More than a million and a half enhancers of feminine pulchritude in a single year! Then the invasion or pervasion of the bob, the gas iron of the beauty parlor. Two years later, production decreased by 200,000; value almost cut in half. No doubt many of those previously sold were laid away, neglected, no longer to draw their morning or evening sustenance of kilowatt-hours.

But there is still hope. She has turned from curling her hair to preparing coffee and toast. The census tells it only a few lines away, again in that finely restrained literary style: "Percolators—1927: Number, 791,726; value, $4,297,395; 1925: Number, 434,095; value, $3,593,496. Toasters — 1927: Number, 1,209,484; value, $3,236,484; 1925: Number, 735,856; value, $1,885,780." And she is further electrifying the breakfast, presumably on Sunday morning: "Waffle irons—1927: Number, 653,893; value, $3,601,411; 1925: Number, 315,777; value, $1,864,257." These are good load builders, and so the story has a message also for the man who is more interested in selling kilowatt-hours than in visualizing ladies preparing coffee and toast.

Now that the method has been shown the reader is free to build up his own scenario to embellish the other stories. And if he is concerned with the sale of electrical appliances or energy, he may find abundant material appropriate for consideration even during business hours in the section of the 1927 Census of Manufactures relating to the electrical industry that begins: "Household heating and cooking appliances: Total value, 1927, $72,933,274; 1925, $75,102,165." The total value of household appliances was lower in 1927 than in 1925 by more than $2,000,000. Volume increased, prices decreased and habits of the people changed.

Evaluating the Advantages of Electric Cooking

WIRT SCOTT'S article, "Are Range Virtues Elusive?" in the March 9 issue of the ELECTRICAL WORLD embodies an approach to the economic valuation of heavy-duty electric cooking hitherto absent from many discussions of this important topic. The author deserves commendation for his willingness to assign dollar values to what have long been regarded as intangible benefits in much commercial electric range operation. Granted that the values assigned required wide experience and seasoned judgment for their selection, we none the less have at hand a basic means of reducing various factors to figures in the study of individual range installations prior to the decision of a hotel, club or restaurant management to adopt electricity in preference to competitive equipment of the fuel-burning type in kitchen service.

Mr. Scott's analysis reveals the vital importance of what many readers would probably class as minor items in connection with heavy-duty electric cooking. Among these are reduced spoilage of food, decreased cost of cleaning kitchen utensils, savings in annual cleaning and redecorating costs, release of employees for other work and improved appearance of the kitchen and allied quarters. Central-station power sales engineers and manufacturers' representatives may prefer to adopt other values for these and associated items, but by appraising them on a scale so low as to disarm criticism they may at the same time be cast into the economic scale and will help turn the balance in favor of electric cooking in not a few instances where their omission might prove a real handicap.

The article referred to is inclusive in other directions and presents an excellent summary of the benefits of commercial electric cooking under present-day conditions. Its attempt to measure values formerly overlooked in general practice so far as quantitative checking goes makes it a reference base upon which others may well seek to build additional structures to support their championship of this valuable branch of load-building enterprise.

* * * *

"Go Thou and Do Likewise!"

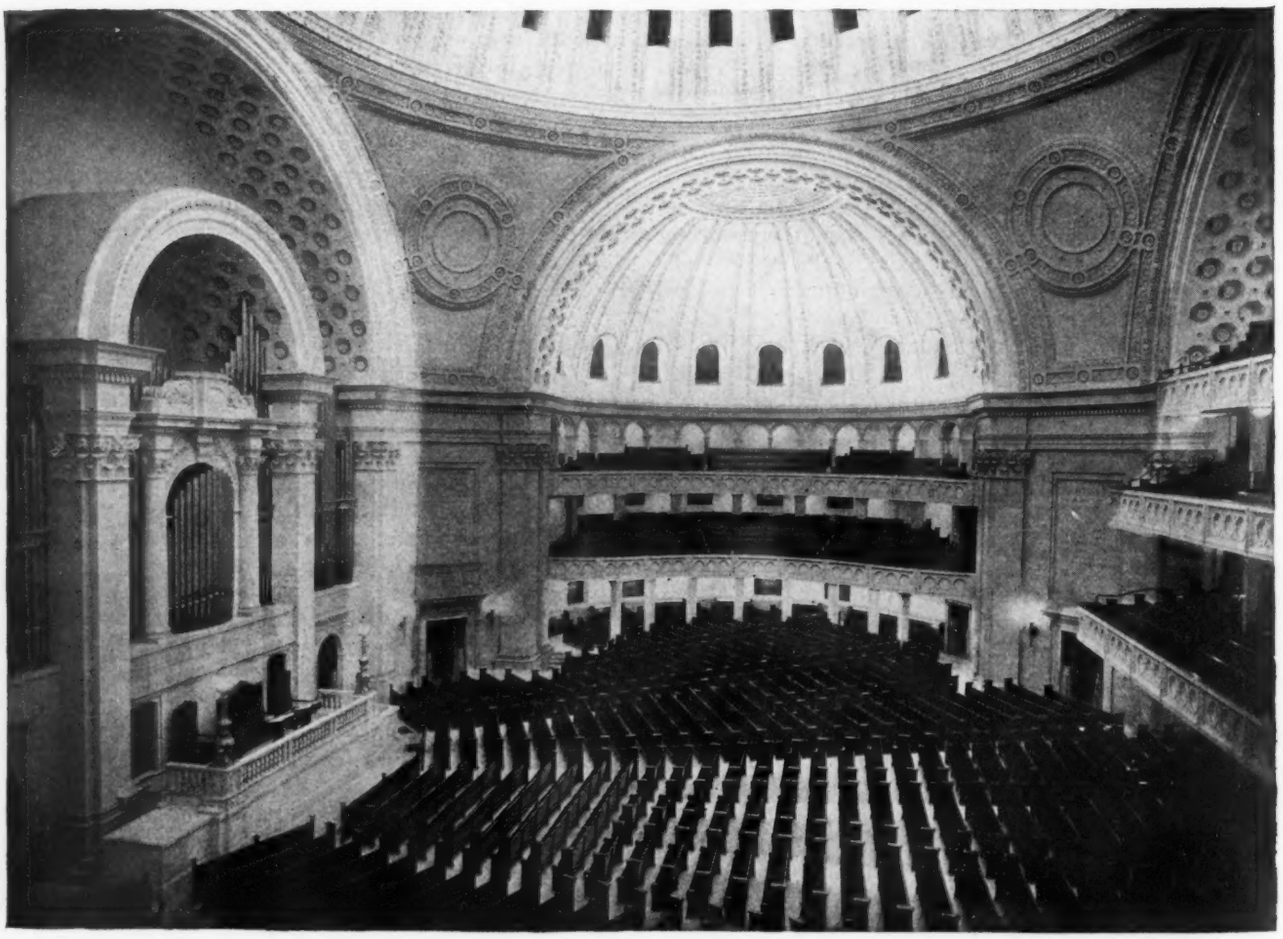
SUCH might have been the text of a homily to industry put forth by President Atterbury of the Pennsylvania Railroad in discussing purchased power for electrification recently before the Boston Chamber of Commerce. In terse phrases the head of this great system recounted the abandonment of a jointly owned power-plant scheme in favor of central-station contractual negotiations, vigorously declaring that the day has passed when the individual industry can afford to manufacture its own power when cheap electrical energy is available to it. On the Pennsylvania's immense program a capital investment of from twenty to thirty millions will be saved by buying power from an industry which specializes in its production and transmission. This idea that every industry should concentrate its energies and resources upon the performance of its own intrinsic tasks is a keynote of the best executive thinking in American business today. The economic inquiry must, of course, be thorough, but given this, the weight of authority resides in the reservation of functions to assure most efficient results. General Atterbury's indorsement of the power industry is most welcome and it is fundamental truth.

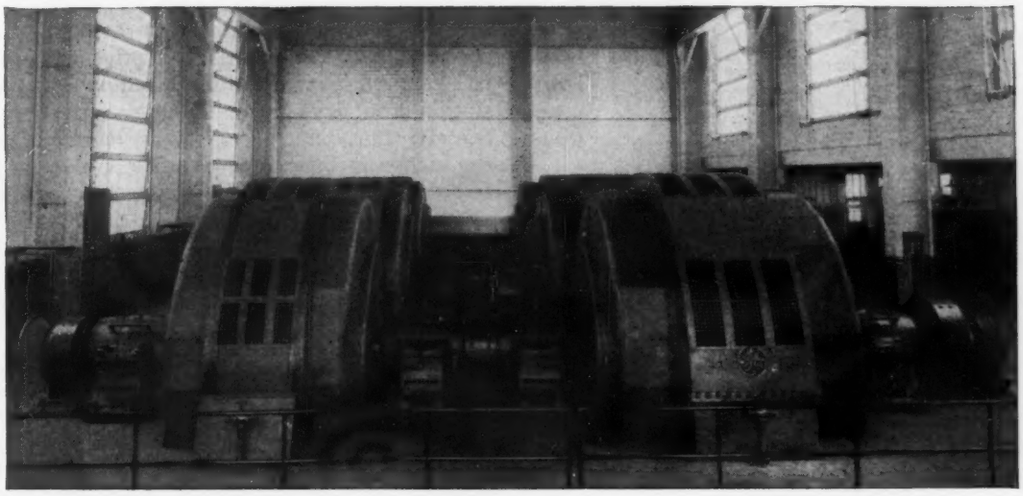
Lighting Raised to High Plane of Esthetic Utility

UNIFORMITY of distribution, absence of glare and the replacement of visible units for major lighting by concealed floodlights feature the improved illumination of the auditorium of the First Church of Christ, Scientist, at Boston.

Indirect lighting of Sunday school room by new 200-watt and 300-watt units

Auditorium after installation of floodlights above dome and around semi-dome coves





Frequency converters in modern railroad-supply substation, Philadelphia Electric Company

Supplying Railroad Power

Special substation of Philadelphia Electric Company serves electrified sections of Pennsylvania Railroad near Wilmington, Del. Frequency converters supply 25-cycle energy to step-up equipment of railroad

By FRANK R. FORD

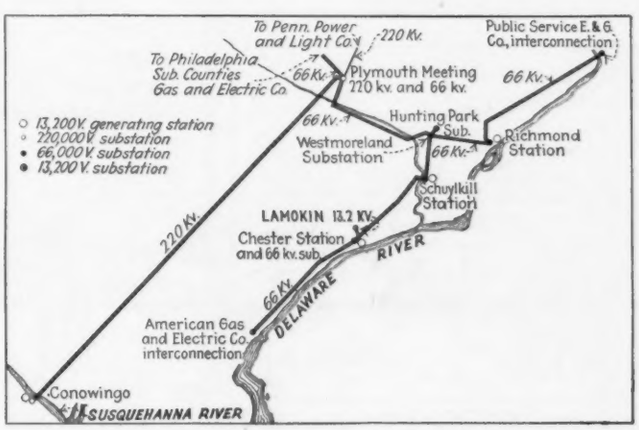
Assistant Chief Designer Station Electrical Division, Philadelphia Electric Company

POWER for the entire 25-cycle, 11,000-volt, single-phase electrification of the Pennsylvania Railroad within the Philadelphia area is provided by the Philadelphia Electric Company. The Wilmington and West Chester branches of the railroad are supplied from the new Lamokin substation and the older branches from the Schuylkill generating station. For the latter service power is transmitted at 13,200 volts, three phase to the Arsenal Bridge substation of the Pennsylvania Railroad, about 13 miles northeast of Lamokin, and there stepped up through T-connected transformers to 44,000 volts, two phase. Transmission to the step-down substations is single phase, the Paoli branch being carried on one phase and the Chestnut Hill branch on the other. Phase converters in the Schuylkill station are intended to correct any unbalance that may exist between phases.

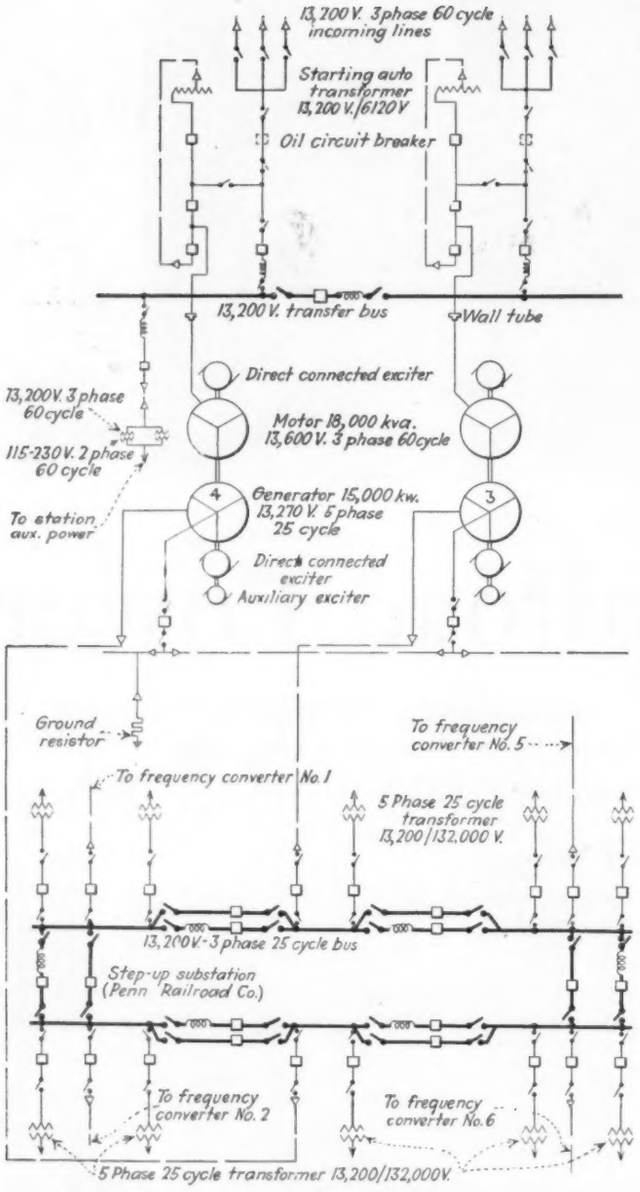
The Lamokin substation is located about a mile from the Chester generating station and near the right-of-way of the Wilmington branch. As Chester generates at 60 cycles, it was decided to install frequency converters at Lamokin. Directly beside this substation is the railroad company's step-up equipment, which in turn is immediately adjacent to the right-of-way of the newly electrified Wilmington branch. Single-phase energy is here transformed from 13,200 volts to 132,000 volts for transmission.

Lamokin is designed for an ultimate installation of six 15,000-kw., single-phase frequency converters, of which three have been installed. The equipment is laid out on the unit plan, each converter being normally supplied by an individual transmission line directly from the Chester generating station at 13,200 volts. This layout affords operating simplicity, minimizes disturbances in the event of failure and is highly economical. The motor of each set is rated at 18,000 kva. and is served by three 6,000-kva., three-conductor cables in multiple. As the generating station is relatively near, adequate stability is expected by operating the converters in parallel on the 25-cycle side. However, provision has been made so that with a minimum amount of modification the 60-cycle ends may be operated in parallel.

So that two converters may be served by a single line, or so that one converter may be supplied by the line to another converter (if outages should make this desirable), a sec-



Lamokin substation as related to Philadelphia Electric and interconnected systems


13,200 V. 3phase 60 cycle incoming lines
Starting auto transformer 13,200 V./6120 V
Oil circuit breaker
13,200 V. transfer bus
Wall tube
Direct connected exciter
13,200 V. 3 phase 60 cycle
115-230 V. 2 phase 60 cycle
Motor 18,000 kva. 13,600 V. 3 phase 60 cycle
To station aux. power
Generator 15,000 kw. 13,270 V. 5 phase 25 cycle
Direct connected exciter
Auxiliary exciter
Ground resistor
To frequency converter No. 5
To frequency converter No. 1
5 Phase 25 cycle transformer 13,200/132,000 V.
13,200 V.-3 phase 25 cycle bus
Step-up substation (Penn Railroad Co.)
To frequency converter No. 2
To frequency converter No. 6
5 Phase 25 cycle transformer 13,200/132,000 V.

Simplified layout for Lamokin showing two of six units

tionalized transfer bus is provided. Sectionalizing reactors may be installed in the transfer bus when it is extended with future machine installations. Both station-auxiliary power circuits are energized by the transfer bus, which is normally connected with one of the incoming lines from which a converter is operating. Each converter has its own starting auto-transformers so that the operating simplicity and safety of the unit plan may be realized to the fullest extent.

The 60-cycle bus, switching equipment and starting transformers are situated outdoors adjacent to the converter and control building.

Three-Phase Windings Offer Stability

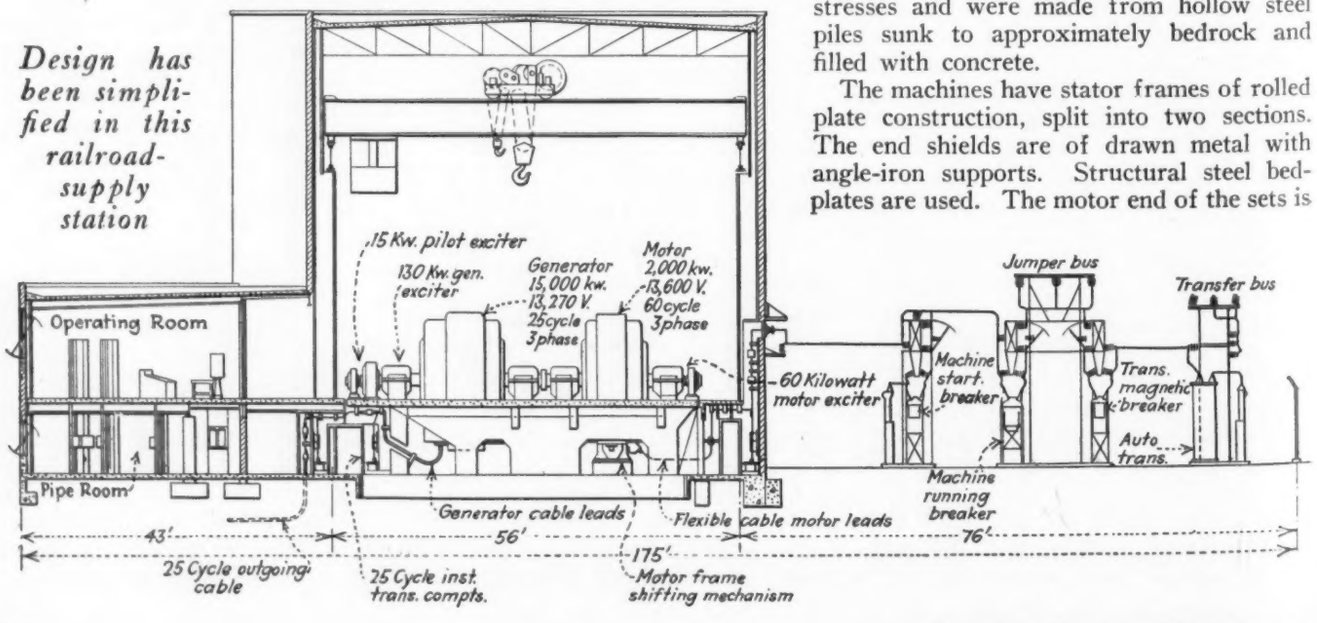
The 25-cycle bus in the railroad's own substation is of the three-phase sectionalized ring type, with provision for sectionalizing reactors. Three phases are provided despite the fact that single-phase energy is used for trains, in order that maximum stability of the converters may be obtained, the latter being equipped with three-phase windings. Relatively little copper is used in the third phase of the generator cables, as there is normally no current in this phase. The step-up transformers are connected to the ring bus, which normally operates unsectionalized.

The frequency converters, made by General Electric, are rated at 15,000 kw., 300 r.p.m., while the generators are rated 13,270 volts, single phase, 25 cycle, 70 per cent power factor and the motors are rated 18,000 kva., 13,600 volts, three phase, 90 per cent leading power factor. The sets will carry 100 per cent overload swings momentarily and continue to maintain normal generator terminal voltage; they will carry 75 per cent overload at a maximum of 14,300 volts with a 70 per cent power factor load. The minimum rating is 11,800 volts, the total range of 22½ per cent being provided to compensate for regulation in the 25-cycle system. Both motors and generators are equipped with damper windings for greater stability of operation and to facilitate starting.

To meet the severe requirement of single-phase service, the generator stator frame is supported by a spring system which absorbs the slightest physical movement. The maximum amplitude of vibration for which the springs must compensate is within 0.0005 in. The foundations of the sets were given special attention to insure successful operation under the most severe stresses and were made from hollow steel piles sunk to approximately bedrock and filled with concrete.

The machines have stator frames of rolled plate construction, split into two sections. The end shields are of drawn metal with angle-iron supports. Structural steel bedplates are used. The motor end of the sets is

Design has been simplified in this railroad-supply station



arranged for frame shifting under load through a total angle of 24 mechanical degrees in order to facilitate synchronizing, and also to permit adjustments of load between machines as may be desired.

The main units are of the inclosed, ventilated type, taking air from the pit below the machines and discharging through the tops of the frames. Circulation is provided by means of fan blades on the rotors. Perforated water-pipe, fire-fighting equipment is installed inside the end bells and adjacent to the air gaps. Bearing oil is circulated through air coolers in the intake air passages by motor-driven pumps.

Separate exciters are used for the motor and the generator, one on each end of the set. Both exciters are of the shunt-wound, commutating-pole type, nominal voltage rating 250 volts. The motor exciter is rated 60 kw. and the generator exciter 130 kw., the latter being necessitated by the large overload swing capacity of the generator. An auxiliary exciter is provided on the generator end of the set for supplying the excitation of the main exciters, this arrangement giving comparatively high speed response to load variations.

The vibrating type of automatic voltage regulating equipment is used for the exciter system, separate equipments being provided for each end of a set. The regulators are so designed that with varying load on the generator there is a corresponding variation in the minimum field adjustment on the motor. This is done that an adequate margin between load and pull-out torques may be maintained.

The generator neutrals are connected through oil circuit breakers to a neutral bus, which is connected to ground through a 4-ohm resistor designed for carrying 2,000 amp. for one minute. The motor neutrals are not grounded, the neutral of the 13,200-volt system being grounded at Chester station.

The running oil circuit breakers for the motors are Westinghouse type O-241, 1,200 amp., 25,000 volts. Similar breakers are used between the supply lines and the transfer bus, as well as for sectionalizing. Breakers may be installed on the incoming lines if operating experience indicates the desirability of doing so. The generator oil circuit breakers are Westinghouse type 0-331, 2,000 amp., 15,000 volts, conforming with the other breakers associated with the 25-cycle bus.

The control system for the station is 125 volts, direct current, involving a double bus arrangement, with one type F-15 chloride battery. Two control sets are installed: the 3½-kw. one normally carries the indicating lamp load and trickle charging of the battery, the other set, 10½ kw., being used to charge the battery after a discharge. In addition to providing control power, the battery supplies emergency lighting through an automatic switch in the event of loss of alternating-current power. The total emergency lighting load, including that in the step-up substation, can be carried for a period of one hour starting with the battery in the fully charged condition, after which a sufficient number of oil circuit breaker operations can be performed to restore the station to normal operating conditions.

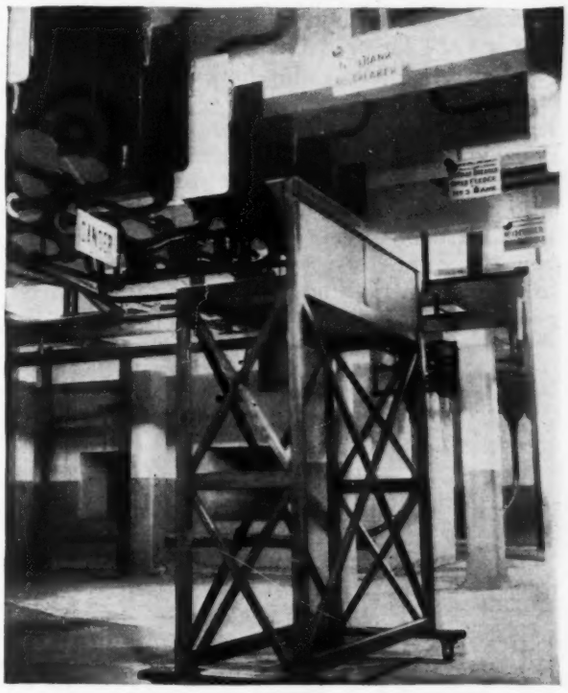
The two station auxiliary power circuits are connected to two 300-kva., oil-insulated, self-cooled transformer banks which are Scott-connected to supply the 230-volt, two-phase, five-wire station light and power bus. The main bus is a single unsectionalized bus. Oil pump motors and frame shifting motors are supplied by a double feed arrangement from cables tapped to the secondary leads of each transformer bank. The control motor-generator sets are supplied in a similar manner.

The relay protection for the 60-cycle end of the substation includes overload and differential relays on the motors of the frequency-converter sets. The starting transformer circuits and auxiliary power circuits are protected by overload relays. The 25-cycle generators are protected by differential and overload relays which function as back-up protection. The 25-cycle ring bus is provided with differential relays which open the generator breakers, as well as the transformer and bus sectionalizing breakers in the event of bus failure.

Safety Provisions in a Substation

By T. A. Robinson
Engineering Department,
City of Winnipeg Hydro-Electric System

WHEN rearranging the layout of a substation recently it was necessary to locate a number of 12,000-volt disconnecting switches in the basement. Here space was somewhat confined and every precaution was taken to make operating conditions as safe as possible. In the accompanying illustration several safety points are shown. Barriers between phases are painted black and those between feeders white. A green pilot light is placed on a board in front of each set of disconnecting switches. This indicates whether the oil circuit breaker is open or closed. The board bears the words, "Do not pull disconnects unless lamp is burning," together with the feeder number, etc.



White and black barriers, lamps indicating positions of circuit breakers and portable protective barrier add to safety

As the hinge point of the switches is only 7 ft. 6 in. from the floor, some method of shielding the blade when it is open and hanging down must be used. For this purpose a special light wooden framework, mounted on casters, was constructed. This supports an asbestos

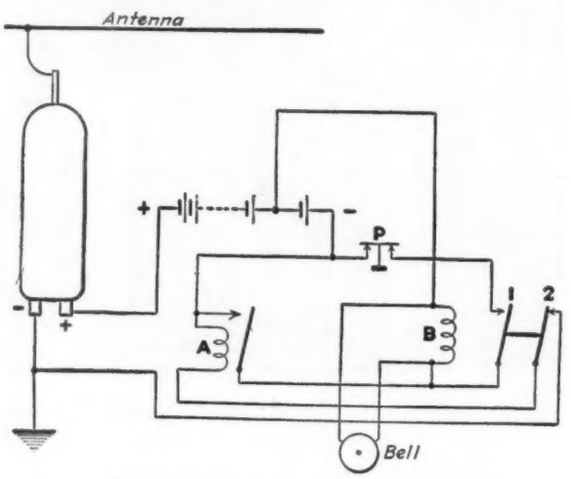
barrier of sufficient width to cover three disconnecting switches, or one feeder. Normally these circuits are closed, thus the use of a device of this portable nature is particularly appropriate, as rarely more than two sets of switches will be open at a time. The construction of this framework is shown quite clearly in the illustration. Two of them may conveniently be kept rolled back out of the way when not in use.

Transient Indicator Uses Low-Voltage Tube

By Edward Beck
Supply Engineer
Westinghouse Electric & Manufacturing Company

THE incorporation of a low-voltage glow tube in a portable outfit which may be used to indicate the passage of transients on a transmission line, to announce the approach of thunderstorms in the field studies of lightning disturbances,* to count lightning arrester operations in the field and to register discharges of laboratory lightning generators has greatly simplified some of the determinations which must be made in such investigations. The instrument is automatic in operation and requires no modification of the circuit which it is to measure.

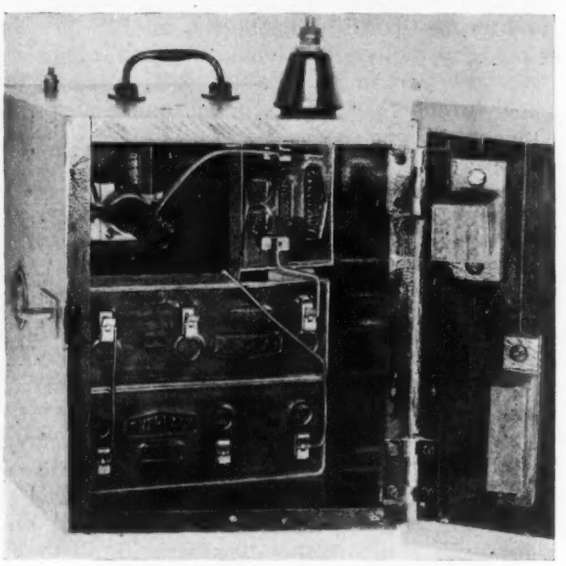
The device depends for its action on the properties of a low-voltage glow tube which is so made that its breakdown voltage is in the order of 120 volts d.c. The application of 110 volts will cause no discharge, but a potential introduced on a third or trigger electrode projecting into the discharge space will cause the tube to act as a relay, permitting current to pass between the



Low-voltage glow tube an essential feature of storm-warning device

main electrodes. This effect may be employed to actuate a relay, ring a bell or for a similar function. If current is once established through the tube it will continue to flow at 110 volts. The circuit must be opened by some means external to the tube, such as a back contact on a relay, whereby the apparatus is reset.

The accompanying illustration shows a self-contained portable unit used for recording lightning arrester operation and consists of a tube, a register equipped with a break contact and a 110-volt B battery. In this device the trigger electrode is connected to the arrester ground lead and when the arrester discharges the potential produced on the trigger trips the tube and operates the register. The register will, however, give no indication



Simple portable equipment used for counting arrester operations

of the voltages which exist. For this klydonograph tests are necessary.

For field lightning investigations the relay tube is arranged to actuate a circuit which rings a bell to summon the operator upon the approach of a storm. In this case the trigger electrode is connected to a short antenna, which is placed parallel to the transmission line. Surges on the transmission line induce disturbances in the antenna, which cause the tube to operate. The circuit may be so arranged that the alarm bell will ring until a button *(P)* is pushed or a time-delay device may cause the bell to ring for a predetermined time. Such an arrangement may be made exceedingly sensitive, depending upon the arrangement of the antenna.

"Apparatus Used in Investigation of Lightning Phenomena," Edward Beck, "Electric Journal," December, 1928.

Underground Service Best, Says M. S. Sloan*

WE HAVE no overhead wires and poles cumbering congested city streets. Everywhere our high-tension transmission feeders are safely buried. It is only in sparsely settled parts of our territory that overhead wires remain. We expect to eliminate them in time.

An underground system is more expensive than overhead construction, but is less liable to accidents which interrupt service. Moreover, every mile of cable underground keeps poles and wires from the surface, thus improving the appearance and value of neighboring property.

**President New York Edison, United Electric Light & Power, Brooklyn Edison, New York & Queens Electric Light & Power, and Yonkers Electric Light & Power Companies.*

Planning Utility Growth*

Budget making and budget control essential to current operation. Method of planning for ten-year growth. Comparison of estimate with actual results

By T. O. KENNEDY

Vice-President and General Manager Ohio Public Service Company

IN THE development of an electric light and power undertaking there are two factors which are fixed either by law or circumstance. These factors are, first, the territory to be served and, second, the maximum rate of return which may be earned on the value of the property used and useful in serving that territory. The most important factor over which the management has control is the degree to which the territory is to be served. This factor is important not only to the owners of the utility but particularly to the citizens of the territory served.

Electric service is so essential to present-day civilization that a community in granting a franchise to an electric utility has a right to demand that the electric property shall be so efficiently constructed, operated and managed that the residents of the community may enjoy the maximum benefits from the use of electricity in their business and home life. The supplying of a certain degree of electric service to a territory may be accomplished without risk and almost without managerial effort, since, up to a certain point, the business of electricity supply is a monopoly and electric service from a central plant meets no competition. Such limited service obviously fails to discharge the obligation of the utility company to the public and also does not permit the owners of the property to realize the full value of their franchise.

It is the duty, then, of the management to so plan and develop the system as to supply the maximum possible service to the territory. Such planning involves an economic study of the territory, a careful market analysis, a sales program for load development, rate studies, construction estimates, operating budgets and a financial plan.

We, in the Doherty organization, have been doing system planning since 1912. We then called it "Operating in Advance"; now we call it "Budgeting." At first our methods were crude and estimates were made for only a half-year period. I can well remember how vociferously the operating executives of the various companies protested the absolute impossibility of predicting, even six months in advance, what their construction expenditures and their operating revenues and expenses would be. Now we prepare system plans over a ten-year period and, annually, in November, we budget every detail of our construction and operating program for the next calendar year. As a measure of the proper functioning of a budget procedure, the accuracy with which the advance estimates are realized is important, but it is also important to consider whether or not those advance estimates were ambitious enough to do full justice to the possibilities of the situation.

In the case of the Ohio Public Service Company our claim as to the accuracy of our estimating is based on the following figures:

During the six-year period 1923-1928 inclusive our actual gross earnings were within one-tenth of 1 per cent of the annual estimate and our actual expenses were within four-tenths of 1 per cent of the annual estimate.

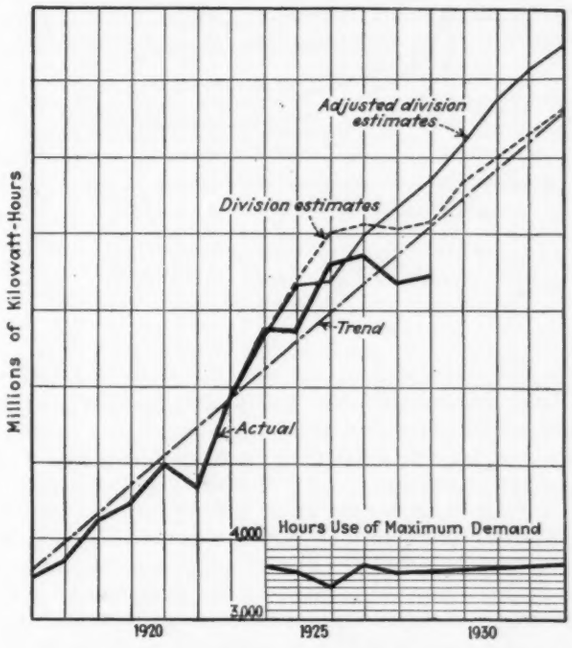


Fig. 1—The method of correlating commercial department estimates of sales, sales from data on past operations and sales adjusted for variable factors

It is, of course, much more difficult to determine whether or not advance estimates take into account the maximum results obtainable. Our claim as to the adequacy of our estimates is based upon the fact that in 1928 our sales of electric light and power service were 1,527 kw.-hr. per capita, or two and seven-tenths times the average for the United States as a whole and two and three-tenths times the average for our own state, Ohio.

It is unfortunately impossible to write or talk about budgeting without making the subject appear much more intricate and involved than it actually is in practice.

**Presented at a meeting of the power systems engineering committee, N.E.L.A., in Cleveland.*

In introducing budgeting into our organization we found that our greatest difficulty lay in getting our executives to concentrate on the subject long enough to understand fully the purpose and method which we had in mind. After they came to appreciate the function of budgeting as an aid in management, instead of merely a mass of

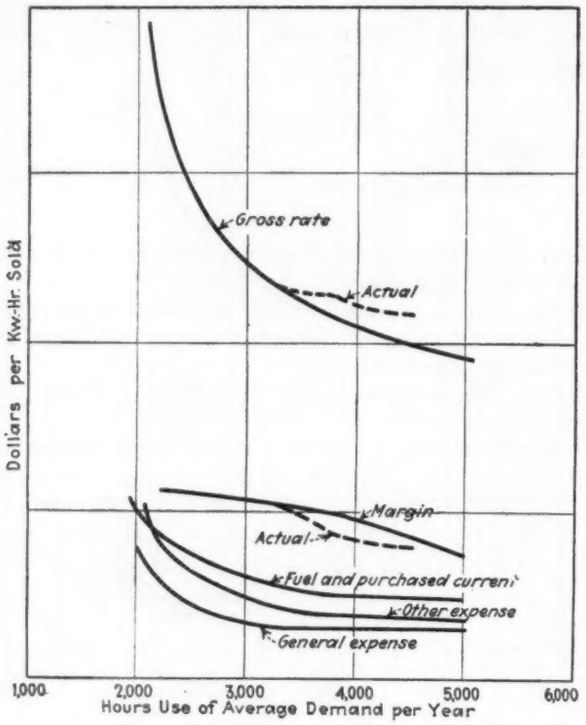


Fig. 2—Method of making gross earnings estimates by using margin earned after expenses are paid

figure work designed to increase the labors of the accounting department, we found them eager to put it into effect.

Since it was our desire to extend the benefits of budgeting as far down the line as was possible, we set out to develop an appreciation throughout our organization of the economics of our business. Our program for doing this included talks to groups of department heads and foremen and articles published in our house organ, which is delivered twice each month to the homes of all employees, and followed this up with an outline of our proposed budgeting procedure, presented in as simple a form as possible and related as definitely as possible to the responsibilities of our various departments.

We do not have in our company a budget department as such. The principles of budgeting are understood and applied by our entire line organization as a means of producing the best results possible in every department of our business. Our budgets are prepared by each supervisory employee for the activity over which he has jurisdiction and we not only permit each department head to do his own budgeting but we encourage him to familiarize every individual employee in his department with the details of the departmental budget.

In so far as the operations of a department are dependent upon conditions outside the control of the department head, we supply him with the necessary information upon which to base his budget. For example, a production superintendent must be advised as to the load and output which the electric generating plant under his direction will be expected to take care of during each month of the budget period. This information is available from the estimates of the sales and distribution departments.

About the middle of October of each year a meeting is held to discuss general business conditions upon which the sales estimate for the following year's budget will be based. In attendance at this meeting are the executives of the general office and the managers and new-business managers of the nine geographic divisions of our company. Directly following this meeting the divisions prepare their detailed estimates of sales and gross earnings and as quickly as the load is allocated they estimate their operating and maintenance expenses. These estimates are made on a monthly basis; that is, the estimated figure for each item is shown for each month of the budget period. The division budget is a consolidation of the budgets from the various sections in each department and, in turn, the various departments in the division. The company budget is a consolidation of the division budgets. No section, department or division head is asked to estimate any item over which he does not have full control.

Budget Control Essential

The supervisory employees are kept constantly advised of their performance as compared with their estimates embodied in the budget. The divisions prepare each month comparative figure sheets on which appear for each item in each budget (1) the actual figure for each month of the preceding year, (2) the original estimate for each month of the current year, (3) the revised estimate for each month of the current year for which revisions have been made and (4) the actual figure for each month of the current year to date.

Revisions as respect the section, department and division budgets extend over the two succeeding months only. The reason for this is that conditions cannot be seen sufficiently accurately for a period longer than 60

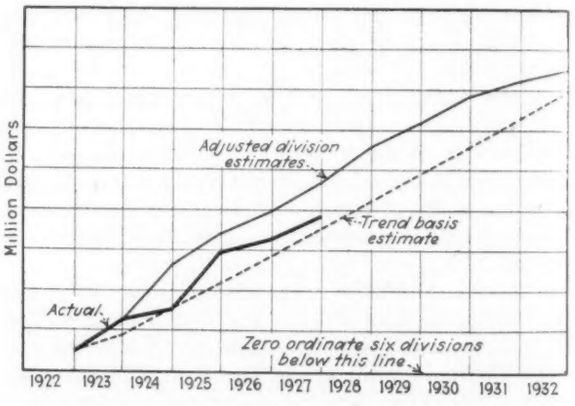


Fig. 3—Gross earnings, actual, compared with estimates

days in advance to enable the supervisory employees definitely to set up their program of work for a longer period than this. We find, however, that supervisors can forecast conditions safely for a period of 60 days and make definite plans so that it is possible to realize economies which come from operating in advance. Revisions as respects the company budget are extended beyond the two months to the end of the year on statistical bases.

The foregoing refers particularly to our annual bud-

geting procedure and is, perhaps, out of place in the consideration of the broader subject of system development which must be planned over a longer period than one year.

Ten-Year Survey Made

In 1922 we made a territory survey and market analysis and on this basis prepared a system development plan covering the ten-year period 1923-1932 inclusive. The territory survey and market analysis can be briefly described by listing the following subheadings which appear therein:

1. Map of territory.
2. General description of territory.
3. List of principal products of territory.
4. Population per square mile (map).
5. Rating of prime movers in manufacturing establishments (equivalent kilowatts per square mile) (map).
6. Percentage of prime movers in manufacturing establishments supplied from central stations (map).
7. Value of manufacturing products added by manufacture per square mile (map).
8. Value of farm land per acre (map).
9. Value of all crops per square mile (map).
10. Value of live-stock products per square mile (map).
11. Value of products from mines and quarries per square mile (table).
12. Electric service supplied to company territory and adjacent territory.
13. Central-station capacity (kilowatts per capita) company territory and adjacent territory.
14. Distribution of population (table).
15. Potential additional maximum kilowatt demand for central station (table).

Our first step in the preparation of the ten-year estimate was a study of the general business conditions likely to affect our territory. The first factor considered was population and curves were plotted to show the rate of growth of the important communities served by the Ohio Public Service Company as compared with other important centers in Ohio and adjacent states.

Since the steel industry is the most important single

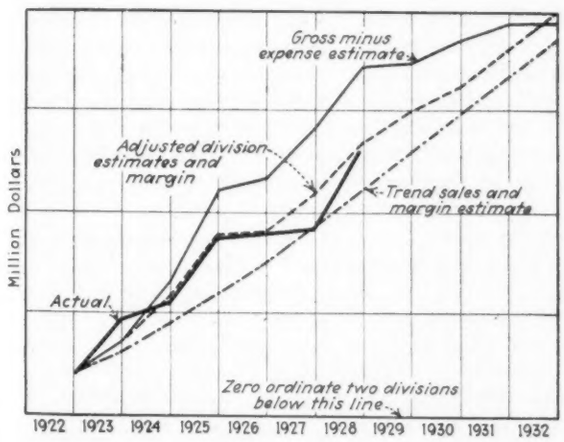

Gross minus expense estimate
Adjusted division estimates and margin
Trend sales and margin estimate
Actual
Zero ordinate two divisions below this line
Million Dollars
1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932

Fig. 4—Net earnings compared with estimates

industry affecting our company's activities, an analysis of the steel business was made and, because the larger part of the finished tonnage put out by the steel plants of our territory is for automobile manufacture, it was necessary to do some forecasting of automobile output during the period of our estimate.

When the data on past performance was plotted it was interesting to note the close relation between yearly changes in the O.P.S. kilowatt-hour sales, the wholesale price of automobiles produced and steel ingot production.

In attempting to analyze the trend of general business, we used as a basis the Harvard Economic Service chart. which utilizes the three factors—speculation, business and money. We also plotted the bank debits of the Fourth Federal Reserve District and the trend of ten industrial stocks on the Cleveland Exchange.

The manager of each geographic division of our company made detail estimates of each class of sales, namely, commercial, domestic, municipal and power. These estimates were corrected in line with our ideas as to the trend of general business, as above arrived at, and the resulting

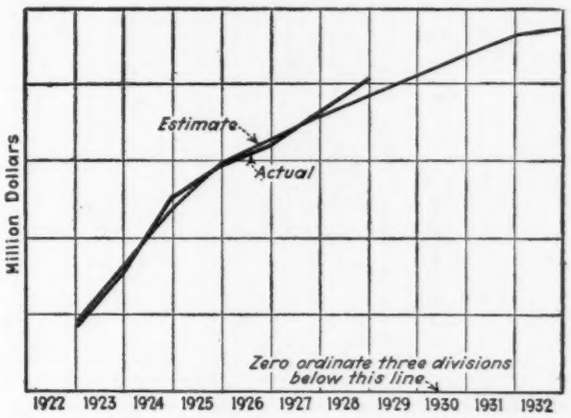

Estimate
Actual
Million Dollars
Zero ordinate three divisions below this line
1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932

Fig. 5—Property valuation compared to estimates

figures were accepted as our maximum estimate of kilowatt-hour sales for the ten-year period.

Our minimum estimate of sales was obtained by extending the curves of past performance on an established trend basis. Maximum and minimum estimates of gross earnings were obtained by applying estimated rates for each class of business to the maximum and minimum sales estimates. Net earnings were estimated on three bases, maximum, medium and minimum.

A ten-year construction program was formulated to provide generation, transmission and distribution capacity to handle the maximum kilowatt-hour sales estimated. Operating and maintenance expenses were estimated in detail, and deducting this expense estimate from the maximum gross estimate gave us our maximum net earnings.

It is, of course, impossible to estimate accurately either gross earnings or expenses over a period as long as ten years in advance. We, therefore, developed a check method for our net earnings estimates which eliminated the effect of error in forecasting such factors as rates, fuel costs and material and labor prices. This check method we will refer to as the "marginal basis of estimating."

From actual records, the hours use of average demands during a number of twelve-month periods were determined and taken as abscissa for curves, the corresponding ordinates being earnings and expense figures per kilowatt-hour sold during the various twelve-month periods.

For a year having a typical load factor the records revealed a certain margin of gross earnings over expenses per kilowatt-hour sold for each class of business and for the total of all sales. This margin of net earnings per kilowatt-hour sold could be adjusted for each year of our ten-year estimate by checking the load factor estimated for each year against the load factor curve above described. In this manner we were able to set up our estimates of medium and minimum net earnings by apply-

ing these margins to our maximum and minimum estimates of kilowatt demands and kilowatt-hour sales.

Six full years of our estimate period have now passed and it would perhaps be of interest to know how the actual figures for these compare with our estimates. In the accompanying tables the minimum estimate of gross

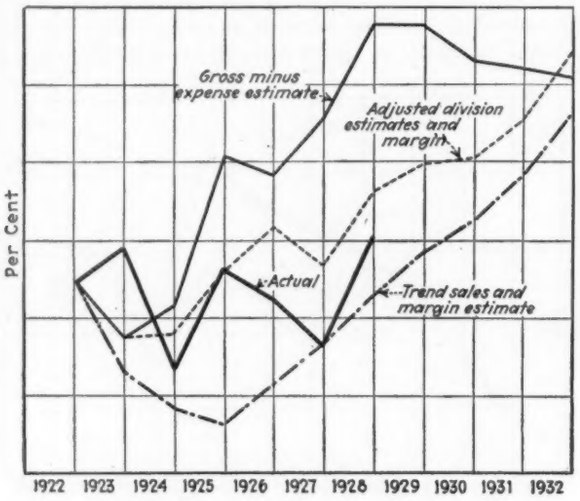

Gross minus expense estimate
Adjusted division estimates and margin
Actual
Trend sales and margin estimate
Per Cent
1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932

Fig. 6—Per cent net earnings to property valuation, actual and estimates

earnings and the medium estimate of net earnings are taken as 100 per cent.

Among the important purposes of long-term estimating are (1) the formulation of a construction program; (2) the economic justification of such program; (3) the preparation of a financial plan to permit such program.

Therefore, after completing our estimate of net earnings on the three bases—maximum, medium and minimum, we set up a complete balance sheet statement on each basis, taking into account such factors as replacement expense, reserve, return on investment, bonds issued, preferred stock issued, common stock outstanding and net to common. A cash estimate was also prepared showing the anticipated cash position of the company for each year of the ten-year period. Since even the minimum estimate of net earnings fully justified our construction program, we were able to proceed with detailed engineering plans for the contemplated projects.

We are firmly convinced of the value of long-term estimating as an aid in the engineering, operation and financing of an electric utility. In fact, we feel that attempting to conduct our enterprise without a long-term budget would be like sailing a ship without a chart and compass.

Of course, it is not possible to devise a routine plan of development that can be followed blindly. Emergencies must be met in our business, but we can be most confident of our ability to meet them if we have previously put down on paper the result of a careful analysis of our future operations.

The worth of a long-term budget does not depend entirely upon the accuracy of the estimate figures. There is a qualitative value that, in our opinion, far outweighs the quantitative value. Nor is the time element of great importance, since it is not necessary in most cases to predict for more than twelve months in advance the actual undertaking of any project.

As an example, our ten-year budget contemplated the construction of a central generating station on the Ohio River. The year has passed when, according to our estimate, this plant would be in operation. Actually, we have been able to postpone this project, but, as a result of its inclusion in our program, we had ample time to select and acquire the plant site, to design the plant in detail and now we are able to keep this design up to date and on less than one year's notice can have the first unit on the line. In this way we can avoid the disadvantages of being rushed into decision, which would certainly be the case if a project of such proportions had to be undertaken on short notice.

Not the least of the advantages of long-term budgeting is the opportunity given the management to evaluate the progress of the company through the establishment of yardsticks of accomplishment, such as population per customer, kilowatt-hour sales per capita, kilowatt-hour sales per customer of different classes, trend of various expense units, rate of capital turnover, etc. We have found, also, that the preparation and administration of our budget provides an excellent opportunity for judging and developing the personnel of our organization.

Table I—Comparison of Gross Earnings with Estimates

Year	Estimated Gross Earnings Maximum, Per Cent	Estimated Gross Earnings Minimum, Per Cent	Actual Gross Earnings, Per Cent
1923	104.8	100	105.0
1924	114.5	100	99.5
1925	115.0	100	109.2
1926	112.5	100	105.0
1927	111.5	100	96.2
1928	112.8	100	95.6
Total six years	111.0	100	101.5

Table II—Comparison of Net Earnings with Estimates

Year	Estimated Net Earnings Maximum, Per Cent	Estimated Net Earnings Medium, Per Cent	Estimated Net Earnings Minimum, Per Cent	Actual Net Earnings, Per Cent
1923	100.0	100	96.5	108.1
1924	104.0	100	92.1	99.0
1925	112.0	100	84.5	99.5
1926	114.0	100	92.0	99.7
1927	114.8	100	92.1	92.3
1928	115.7	100	89.8	92.4
Total six years	109.5	100	91.8	98.6

Table III—Comparison of Property Value with Estimates

Year	Estimated, Per Cent	Actual, Per Cent
1923	100	98.5
1924	100	102.5
1925	100	99.0
1926	100	93.5
1927	100	100.0
1928	100	101.8
Total six years	100	99.5

Further Hydro Development in Italy

A NEW hydro-electric station, known as the Fraele-Viola, has lately been completed and put in operation by the municipal authorities of Milan. The plant, which has a capacity of 45,000 hp., consists of three groups of 15,000-hp. turbines and generators and is expected to supply 100,000,000 kw.-hr. per year. For transmission to Milan from this station the power is stepped up to 150,000 volts.

Getting Along with People

One executive who has been very successful in building good will considers the essentials which may lead to better public relations

An Interview with
J. H. SHEARER
Vice-President and General Manager
Penn Central Light & Power Company,
Altoona, Pa.

J. H. Shearer

FORTUNATELY the electric light and power business has been blessed with some executives who recognize that human relations deserve as much attention as technical, financial and commercial problems. Guided by their example, most utilities have for years been devoting major attention to means of securing and retaining public good will. Hardly a company in the United States exists that does not follow some practice that might be emulated. A few companies have combined many worthy methods. But owing to the criticism which was heaped on utilities for years for not telling the public more about their business there has been a tendency among some companies to think of publicity as the royal path to greater public favor.

Dissemination of information that the public wants must continue, but good will cannot be secured by publicity alone or too great a portion of it. Companies which have been most successful in acquiring public favor have attained their results by giving more attentive consideration to the removal or avoidance of the little, rankling incidents which can occur in any contact with the customer unless guarded against and which collectively breed ill will that is manifested by criticisms of rates, monopoly, private capital, etc., for lack of a better peg on which to hang dissatisfaction.

The possible causes of irritation must be known and avoided by every member of a utility organization so that all relations are harmonious and friendly. If some company practice or policy interferes the department head or even a ranking officer should know it. The problem simmers down to having at the head of the organization an executive who appreciates the value of good will and who will bend every effort to secure it by setting an example for employees and creating an internal morale which will reflect that attitude without set rules and regulations.

Several executives could be named who possess the ability of creating the correct employee morale for securing public good will, but J. H. Shearer of Altoona is one who has developed that ability to a high degree by his exemplary methods.

When Mr. Shearer was visited by the writer his door was open, but a card was offered to his secretary. She did not go through the usual formality of seeking a hearing, but said: "You may go right in." He was most hospitable in his reception, and having never met the gentleman before I considered his attitude typical of every public meeting. Later occurrences checked this opinion.

Asked about his public relations, he immediately responded by saying: "Why don't you go out and ask some of our customers; we might have a prejudiced viewpoint." The writer did so by visiting some merchants, shopkeepers, etc., and even seeking criticism, but none was found. Furthermore, when members of the organization, to whom the writer was unknown, were approached, it was obvious from the treatment received that the casual test of public relations was typical of what might be found on a more extensive survey.

Mr. Shearer was again

To be productive of lasting results the sentiments expressed in this interview must be felt first by the manager of the company seeking better public relations. The make-up of his character must be such that he views his company's operation in a balanced and broad manner.

Any manager who does not do this and does not have a full appreciation of his duties as a citizen from a self-sacrificing and unselfish angle can hardly expect to make a success in operating any electric company or in creating and maintaining friendly contact with the public.

No mention is made in this interview of such activities as pension and sick benefits for employees, employee welfare and educational activities, membership in civic organizations, contributions to charitable and civic enterprises, advertising in newspapers, training of employees, handling customers' complaints, uniformed meter readers, neatness and cleanliness of employees, stores and stations, customer ownership of securities, etc., because nearly every company considers these factors whether they are successful or unsuccessful in their public relations activities.

approached to ascertain what had developed this enviable position. His first comment was:

"When a customer walks into a merchant's store to buy an article and he receives a courteous reception, prompt and efficient service, a reasonable price is given on the article and a thank you and good day are extended to him when he leaves the customer is satisfied that he has received everything that he expected and was entitled to as a patron of the store. The customer does not have the idea that because he has received courteous treatment and good service the merchant has any ulterior motive in pleasing his patrons other than the desire to conduct a successful enterprise. No aspersions are cast upon the motives of the merchant for operating a store which endeavors to satisfy its customers. Why there should be any difference in the reaction of the public toward the successful merchant and the successful public utility corporation is not easy to understand. If one is looking for a reason, it may be due to the fact that quite often too much effort is made on the part of the utility company to clothe its relations with the public in an air of mystery.

"When everything is said and done, public relations is only the art of getting along with people. How to acquire and practice this art is a problem which seems to be difficult for some companies and easy for others. It should not be assumed that the companies that do get along in an easy manner with their patrons do so without effort, planning and close attention to every detail of the operation of their companies. It takes united and untiring effort on the part of all members of a company to create and maintain the proper feeling between the company and the public. Years ago Thomas Carlyle said: 'For not this man and that man, but all men make up mankind and their united tasks are the task of mankind.' When the sentiments expressed by Thomas Carlyle are evident in a public utility you may be sure that its relations are sound and friendly with the public.

"It would be an idle task to attempt to develop any set formula to create in an organization the feeling of common brotherhood and duty as expressed by Carlyle. All one can do is cite certain attributes which have a bearing on the development in an organization of the sentiments expressed by Carlyle which are the foundation of a sound public relations program in any company."

Must Win Employee Good Will First

About this time Mr. Shearer called several of his organization heads into his office to discuss the subject. Each entered with respect, but there was a pleasing informality and absence of servility that indicated that he ruled by the respect he had created for his man-to-man dealings rather than by force or merely position. There was an unfeigned enthusiasm in each speaker's comments regarding the importance of public good will and a keen appreciation of what riles the public and how irritation can be avoided in different contacts. What impressed me the most was the spirit which activated each one and the happy blending of a company and public viewpoint.

After the members of his organization had left the office, the reason for this high morale was sought from Mr. Shearer, who pointed out:

"A utility company cannot hope to have its employees assume the right attitude toward its patrons if the policies and practices of the company are not just and fair with its employees. Good employee relationship is the outgrowth of competent leadership. Favorable employee relationship can only be established by the elimination of deception, the creation of the feeling that the employee is not merely a man or a woman whom in the natural course of life must work for pay alone, and the understanding that wages and opportunities for advancement are commensurate with results achieved by the employees. Without the proper *esprit de corps* among the employees in a company organization it is presumptuous to expect the company to enjoy friendly relations with the public. The employees must be trained to have the public service spirit. The public service spirit must exist in and emanate from the local chief executive of the public utility company. The chief executive must select for his immediate staff those men who are qualified for their positions from the standpoint of knowledge of the business, social standing and character, who recognize their positions as public servants and who can pass on to their subordinates the public service spirit.

"No one man can do all the planning, all the thinking and all the arranging for a large utility company. Most of this work has got to be done by departments with a wide scope of authority. The department head cannot be cramped as to 'red tape' in carrying out his plans as long as they are sound and constructive. When the authority of a department head becomes so limited that he is handicapped in performing his work you may be sure that employee relationship trouble will develop and, ultimately, trouble with the public. On the other hand, no department head, because he has been delegated a wide scope of authority, should assume autocratic powers. A department head must always keep in mind never to abuse a privilege and that the success of his department depends to a large extent upon his manifesting the proper spirit of co-operation and patience with the problems of the other departments and the entire company."

This explanation partly accounts for the fact that each member of the Penn Central Light & Power Company is a public relations man. But each realizes that public relations activities must be more than gestures; they are carried on because it is good business to do so and no attempt is made to make the public believe otherwise.

Good Service Essential

Commenting on service—the all-inclusive term covering so many intangibles—Mr. Shearer said:

"Without reliable service a utility company can never expect to gain the respect of its patrons. It is an impossibility for a company to be altogether free of interruptions; however, if interruptions do occur the spirit of the company in handling these interruptions can offset to practically the full extent any unfavorable reaction on the part of the patrons. A company can have only one of two policies. These policies can be classified as 'do nothing' or 'ever ready.' A company will soon be put into one of these classes by its customers according to its attitude in handling customer relations and service in the territory in which it operates.

"Satisfactory employee relations and dependable departmental initiative and co-operation have a decided bearing on the service of a company. Adequate funds for maintenance and rehabilitation should be provided in line with the ideas of the department heads, for to ignore the knowledge and vision of department heads on the needs of a company only invites service trouble and the ill will of the public at a later date."

While criticism of rates is more often the symptom of public dissatisfaction than the cause, Mr. Shearer pointed out:

"Any public utility company which fails to lay its cards on the table in rate questions that might arise can expect violent response from the public. If a company expects the public to be fair with it the company has a right to be fair with the public. Where rate questions do come up it is always the better policy to explain to the customers in advance the reasons for the adjustments or changes which are to take place.

"The rates of a company should be reasonable and simple to understand. It is idle to ignore the fact that most of the discussion which takes place among the customers of an electric company is based on rates and service. The electric company is selling a useful commodity involving the mass of the people and the people are interested just as much in the price and quality of the commodity sold by the electric company as they are in any other commodity which they are obliged to purchase and utilize. An effort on the part of any company to ignore these facts will create only an extremely unfriendly feeling between the company and the public."

Attempts to secure good will by participation in civic affairs, if overdone, or made just for show, may defeat its purpose, but Mr. Shearer and his men engage in such activities unostentatiously, purely with the spirit which should actuate any good citizen, so his comments on the subject may be of interest:

"It should never be the policy of any utility to overlook its responsibilities and duties in community enterprises. If a utility serves a community it should be generally understood by every person connected with the company that it is the policy of the company to be as much interested in the welfare of the community served as any of the other citizens or business establishments located in that place. A spirit of progressiveness and optimism should be manifested by the company executives and the employees in their work and in community movements. There is no need to lend any color or make-up to the actions of the company to create a good impression, the only requisite being a will to co-operate in a sincere manner with every possible forward effort for a community's development and advancement. Everything that is done should be done from the heart and not reluctantly. A utility should be the leader rather than the follower in civic development. A spirit of service should prevail with the employees to such a degree that their own initiative should indicate to them exactly what their relations are as citizens of a community."

Executive leadership and example and a high degree of employee morale are foundations on which good-will building must start. With these provided, the public is more assured of receiving what it wants—the highest grade service which the rates will warrant. And service means not only reasonable voltage regulation and continuity of service in adequate amounts but agreeable relations with every utility employee, whether he be the telephone operator, application or complaint clerk, cashier, service man, meter reader or construction man. How such individuals and those in other departments avoid irritating relations with the public or seek to remove irritations when they occur are the practices which utilities will study who are sincerely seeking better public relations.

Precast Concrete Service Boxes on Underground Distribution Lines

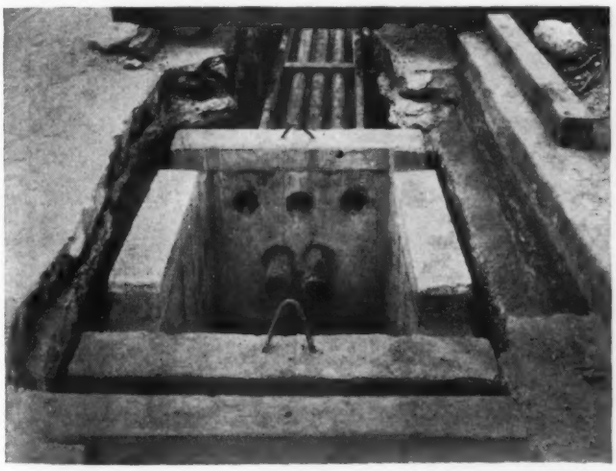
By C. H. Shaw

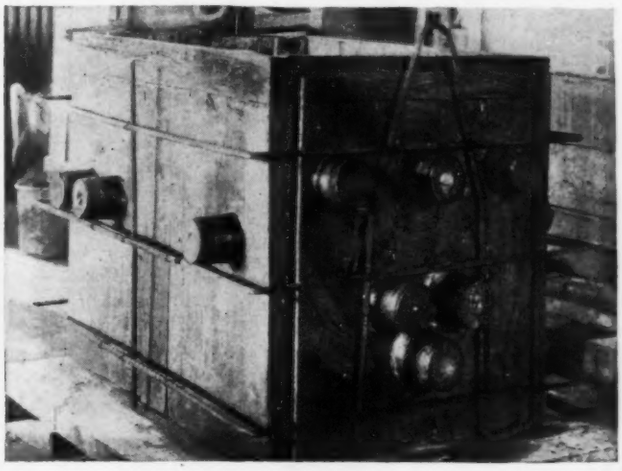
Acting General Superintendent Transmission and Distribution, New York Edison Company

THE use of precast service boxes makes it possible to build a distribution system with a minimum delay to traffic and interference of abutting property owners, since no time is lost in waiting for concrete to harden before the conduit lines can be built into them. The precast boxes are placed in position first and the conduit line is immediately started from each end of the service box and may be backfilled within 24 hours after excavation.

The precast concrete boxes are manufactured at any location convenient for labor and material and after being brought to the location they are readily placed in position by means of four-legged handwheel windlass.

The forms for the duct entrances do not pass completely through the concrete to the outer shell. They are incased in a paper mold which is allowed to remain in the concrete when the inner sections of the form are removed. The vacant duct in the precast service box is provided for future selection of service pipes for street lighting or commercial connections. These are in the form of knockouts, the outer edge of concrete being entirely closed. Service pipes may be inserted through these holes by simply driving out the concrete and is placed over the duct location. This arrangement provides for uniform entrance of service cables into the service box and establishes a uniform method of cable racking.





Precast service box being installed and inside form used in casting

13,571,530 Hp. of Developed Water Power

THE total capacity of waterwheels installed in water-power plants of 100 hp. or more in the United States on January 1, 1929, was 13,571,530 hp., an increase of 1,275,530 hp., or 10.4 per cent, during 1928, according to a report recently published by the U. S. Geological Survey. The increase in 1927 was only 575,000 hp. The gain in 1928 was therefore more than twice that during 1927.

Water-power development is apparently proceeding without being handicapped by the keener competition caused by the remarkable advance in the efficiency of fuel-burning plants since 1919. It is probably true that the time may not be far distant when the construction of water-power plants will be restricted by the advantages of modern steam plants, but the increase in the developed water power in recent years apparently indicates that this time has not yet arrived, according to the view expressed in the Survey's report.

The following table shows the total capacity of waterwheels in water-power plants in the United States at different dates and the increase between dates:

Date	Horsepower	Increase	
		Horsepower	Per Cent
1921 (November)	7,926,958	.....	....
1924 (March)	9,086,958	*1,160,000	14.6
1925 (March)	10,037,655	950,697	10.5
1926 (January 1)	11,176,596	†1,138,941	11.3
1927 (January 1)	11,720,983	544,387	4.9
1928 (January 1)	12,296,000	575,017	4.9
1929 (January 1)	13,571,530	1,275,530	10.4

*About 2.3 years. †About 0.8 year.

Distribution of Developed Water Power in United States, 1921, 1925-1929

Division	Percentage of Total in United States					
	1921	1925	1926	1927	1928	1929
New England	16.5	14.0	13.3	13.1	12.7	12.2
Middle Atlantic	18.7	19.4	17.9	17.5	16.9	15.6
East North Central	9.3	8.8	8.8	8.6	8.4	8.0
West North Central	5.6	5.1	4.7	4.6	4.4	4.1
South Atlantic	13.6	15.8	15.2	15.7	16.0	19.1
East South Central	3.1	4.0	6.7	7.4	7.9	8.2
West South Central	.2	.3	.3	.3	.4	.4
Mountain	10.4	9.3	8.8	8.8	9.1	8.4
Pacific	22.6	23.3	24.5	24.0	24.3	24.0

Rank of the Ten Leading States in Developed Water Power, 1921, 1926-1929

	1921		1926		1927		1928		1929	
	Rank	Per Cent of U.S. Total	Rank	Per Cent of U.S. Total	R	Per Cent of U.S. Total	Rank	Per Cent of U.S. Total	Rank	Per Cent of U.S. Total
New York	1	16.3	2	15.7	2	15.0	2	14.5	2	13.3
California	2	14.5	1	16.4	1	16.4	1	16.2	1	16.4
Washington	3	5.7	3	5.9	4	5.6	3	5.7	5	5.5
Maine	4	5.7	7	4.4	7	4.5	7	4.4	8	4.0
Montana	5	4.3	10	3.4	10	3.2	..	....	..	....
Massachusetts	6	4.3	..	....	..	....	..	....	..	....
Wisconsin	7	4.2	8	4.0	8	4.0	8	3.9	9	3.8
South Carolina	8	4.2	5	4.6	5	4.9	6	4.7	6	4.2
North Carolina	9	4.2	5	4.8	6	4.6	5	5.2	3	6.0
Georgia	10	3.5	9	3.9	9	3.8	9	3.8	7	4.0
Alabama	..	....	4	4.8	3	5.6	4	5.3	4	5.9
Michigan	..	....	..	....	..	....	10	3.1	..	....
Maryland	..	....	..	....	..	....	..	....	10	3.1
Total		66.9		67.9		67.6		66.8		66.2

The other tables show the distribution of the developed water power and the relative activity of development in the different divisions of the United States, the rank of

Developed Water Power in the United States, January 1, 1929

(Plants of 100 Horsepower or More)

Division and State	Total		Public Utility and Municipal		Manufacturing and Miscellaneous	
	No. of Plants	Capacity in Horsepower	No. of Plants	Capacity in Horsepower	No. of Plants	Capacity in Horsepower
United States	3,375	13,571,530	1,605	11,886,336	1,770	1,685,194
New England	1,203	1,653,654	262	879,914	941	773,740
Middle Atlantic	592	2,122,999	243	1,854,008	349	268,991
East North Central	390	1,075,660	265	841,435	125	234,225
West North Central	202	555,049	152	442,786	50	112,263
South Atlantic	338	2,595,304	173	2,444,992	165	150,312
East South Central	52	1,118,765	40	1,116,081	12	2,684
West South Central	34	47,082	23	43,577	11	3,505
Mountain	248	1,140,108	197	1,117,820	51	22,288
Pacific	316	3,262,909	250	3,145,723	66	117,186
New England:						
Maine	253	538,761	79	239,801	174	298,960
New Hampshire	244	278,002	62	143,711	182	134,291
Vermont	197	260,157	67	216,501	130	43,656
Massachusetts	325	362,123	28	159,211	297	202,912
Rhode Island	59	30,188	5	3,285	54	26,903
Connecticut	125	184,423	21	117,405	104	67,018
Middle Atlantic:						
New York	508	1,813,501	190	1,559,695	318	253,806
New Jersey	34	18,902	10	8,658	24	10,244
Pennsylvania	50	290,596	43	285,655	7	4,941
East North Central:						
Ohio	24	30,320	16	25,236	8	5,084
Indiana	26	56,521	17	50,620	9	5,901
Illinois	31	93,772	16	76,797	15	16,975
Michigan	134	378,315	113	319,884	21	58,431
Wisconsin	175	516,732	103	368,898	72	147,834
West North Central:						
Minnesota	73	292,649	49	198,327	24	94,322
Iowa	46	182,139	39	181,012	7	1,127
Missouri	7	20,560	5	20,260	2	300
North Dakota	1	245	0	0	1	245
South Dakota	9	19,671	5	7,050	4	12,621
Nebraska	45	23,649	41	22,954	4	695
Kansas	21	16,136	13	13,183	8	2,953
South Atlantic:						
Delaware	3	1,161	0	0	3	1,161
Maryland	16	415,815	5	411,765	11	4,050
District of Columbia	3	5,870	1	4,520	2	1,350
Virginia	63	140,239	33	98,625	30	41,614
West Virginia	12	91,279	7	81,174	5	10,105
North Carolina	120	814,000	50	775,000	70	39,000
South Carolina	60	574,000	33	546,000	27	28,000
Georgia	58	543,685	41	518,653	17	25,032
Florida	3	9,255	3	9,255	0	0
East South Central:						
Kentucky	7	142,255	4	141,351	3	904
Tennessee	31	177,425	24	176,170	7	1,255
Alabama	14	799,085	12	798,560	2	525
Mississippi	0	0	0	0	0	0
West South Central:						
Arkansas	4	15,680	4	15,680	0	0
Louisiana	0	0	0	0	0	0
Oklahoma	4	1,948	4	1,948	0	0
Texas	26	29,454	15	25,949	11	3,505
Mountain:						
Montana	31	393,440	29	391,500	2	1,940
Idaho	54	357,577	47	354,575	7	3,002
Wyoming	11	17,355	10	17,029	1	326
Colorado	57	98,016	28	84,281	29	13,735
New Mexico	6	1,510	5	1,285	1	225
Arizona	10	104,360	10	104,360	0	0
Utah	69	154,200	59	151,440	10	2,760
Nevada	10	13,650	9	13,350	1	300
Pacific:						
Washington	74	747,407	68	704,275	6	43,132
Oregon	83	288,973	50	234,001	33	54,972
California	159	2,226,529	132	2,207,447	27	19,082
Outlying possessions:						
Alaska	....	32,000	....	.....	....	.....
Hawaii	....	32,224	....	.....	....	.....
Porto Rico (1925)	....	15,000	....	.....	....	.....

the ten leading States in developed water power for different years and the total capacity of waterwheels in plants of 100 hp. or more, segregated between public utility and manufacturing plants, by states and divisions.

For a comparison with the development in the individual states two years ago the table in the ELECTRICAL WORLD of April 9, 1927, page 786, may be consulted. Corresponding figures for potential water power and for developed power in earlier years were published in the issue of January 1, 1927, on pages 60 and 61.

Improvement in Utilization of Fuel by Public Utilities Continued During 1928

PRELIMINARY figures of the total annual production of electricity by public utility power plants in the United States indicate an output of 87,851,000,000 kw.-hr. in 1928, an increase of nearly 10 per cent over the output for 1927, the Geological Survey reports.

Water power was used to generate 34,747,000,000 kw.-hr., or about 40 per cent of the total output for the year; it has generated more than one-third of the electricity produced by public-utility power plants every year from 1919 to 1928. During the past four years the output from this source has increased more rapidly than the output by fuel power, and in 1928 the ratio would have been more than the 40 per cent attained but for the abnormally dry weather in the latter part of the year, which reduced the water supply of the streams used for power.

The amount of electricity generated by the use of fuels was 53,104,000,000 kw.-hr., or 60 per cent of the total. Of this amount, coal was used in the generation of 88 per cent, gas 7 per cent, oil 4 per cent and wood less than 1 per cent.

Public utility companies and their power plant operators were again successful in increasing the efficiency in the utilization of fuels in the generation of electricity. The amount of electricity generated by the use of fuels in 1928 was 5.5 per cent more than in 1927. The amount of fuel consumed, however, was only 1.1 per cent more than in 1927. The increase in output was therefore five times as much as the increase in the amount of fuel consumed. The average rate of fuel consumption for the entire United States in 1927 was 1.84 lb. of coal per kilowatt-hour; in 1928 the rate was reduced to 1.76 lb., a reduction of 0.08 lb., or about 1¼ oz. per kilowatt-hour. This small saving per kilowatt-hour in generating the 53,000,000,000 kw.-hr. of fuel-generated electricity, however, amounted to 2,120,000 tons in the year, which is

Annual Production of Electricity and Consumption of Fuel by Public-Utility Power Plants in the United States

	Output (Thousands of Kilowatt-Hours)				Fuel Consumption		
	Total	Water Power	Fuel Power	By Use of Wood*	Coal (Net Tons)	Oil (Barrels)	Natural Gas (Thousand Cubic Feet)
1928							
United States	87,851,120	34,747,188	53,103,932	371,285	41,336,138	7,125,922	77,173,517
New England	5,939,035	2,371,980	3,567,055	0	2,741,960	566,585	0
Middle Atlantic	22,656,156	6,524,515	16,131,641	0	12,936,434	344,872	91,699
East North Central	20,950,962	2,632,252	18,318,710	9,298	15,753,958	79,596	4,206,493
West North Central	5,117,383	1,756,214	3,361,169	8,800	3,458,576	930,499	8,777,571
South Atlantic	10,552,812	5,586,505	4,966,307	5,541	3,683,496	2,078,807	176,849
East South Central	3,326,112	2,640,448	685,664	4,419	904,509	80,846	15,824
West South Central	4,025,090	48,663	3,976,427	558	1,276,635	1,127,344	50,225,176
Mountain	3,916,719	3,427,377	489,342	17,903	539,942	254,439	830,687
Pacific	11,366,851	9,759,234	1,607,617	324,766	40,628	1,663,564	12,849,218
1927							
United States	80,205,474	29,875,008	50,330,466	335,899	41,888,497	6,782,199	62,919,197
New England	5,470,556	1,989,386	3,481,170	0	2,709,503	858,289	0
Middle Atlantic	21,716,770	6,216,326	15,500,444	0	12,883,508	342,462	124,947
East North Central	18,843,349	2,409,740	16,433,609	11,390	14,872,766	68,456	5,518,869
West North Central	4,841,453	1,650,173	3,191,280	7,852	3,497,025	815,534	8,698,147
South Atlantic	8,768,076	2,998,728	5,769,348	6,579	4,549,893	2,048,991	159,032
East South Central	3,407,700	2,211,600	1,196,100	2,126	1,380,465	57,977	13,798
West South Central	3,315,382	66,737	3,248,645	5,848	1,406,678	929,581	40,748,078
Mountain	3,520,047	3,033,688	486,359	13,683	581,413	225,889	515,955
Pacific	10,322,141	9,298,630	1,023,511	288,421	7,246	1,435,020	7,140,371

* Included in fuel power.

Annual Production of Electricity by Public-Utility Power Plants in the United States, 1919-1928

	Total		Water Power			Fuel Power		
Year	Kilowatt-Hours	Change from Previous Year (Per Cent)	Kilowatt-Hours	Per Cent of Total	Change from Previous Year (Per Cent)	Kilowatt-Hours	Per Cent of Total	Change from Previous Year (Per Cent)
1919	38,921,000,000	.....	14,606,000,000	37.5	.....	24,315,000,000	62.5	.....
1920	43,555,000,000	+11.9	16,150,000,000	37.1	+10.6	27,405,000,000	62.9	+12.7
1921	40,975,000,000	— 5.9	14,970,000,000	36.5	— 7.3	26,005,000,000	63.5	— 5.1
1922	47,654,000,000	+16.3	17,207,000,000	36.1	+14.9	30,447,000,000	63.9	+17.1
1923	55,665,000,000	+16.8	19,343,000,000	34.8	+12.4	36,322,000,000	65.2	+19.3
1924	59,014,000,000	+ 6.0	19,969,000,000	33.8	+ 3.2	39,044,000,000	66.2	+ 7.5
1925	65,870,000,000	+11.6	22,356,000,000	33.9	+11.9	43,514,000,000	66.1	+11.4
1926	73,791,000,000	+12.0	26,189,000,000	35.5	+17.1	47,602,000,000	64.5	+ 9.4
1927	80,205,000,000	+ 8.7	29,875,000,000	37.2	+14.1	50,330,000,000	62.8	+ 5.7
1928	87,851,000,000	+ 9.5	34,747,000,000	39.6	+16.3	53,104,000,000	60.4	+ 5.5

Annual Consumption of Fuel in the Production of Electricity by Public-Utility Power Plants in the United States, 1919-1928

Year	Coal — Short Tons	Coal — Change from Previous Year (Per Cent)	Fuel Oil — Barrels	Fuel Oil — Change from Previous Year (Per Cent)	Gas — Thousand Cubic Feet	Gas — Change from Previous Year (Per Cent)
1919	35,100,000	.....	11,050,000	.....	21,406,000	.....
1920	37,124,000	+ 5.8	13,123,000	+18.8	24,702,000	+15.4
1921	31,585,000	—14.9	12,045,000	— 8.2	23,722,000	— 4.0
1922	34,179,000	+ 8.2	13,197,000	+ 9.6	27,172,000	+14.5
1923	38,966,000	+14.0	14,684,000	+11.3	31,433,000	+15.7
1924	37,556,000	— 3.6	16,630,000	+13.3	48,443,000	+54.1
1925	40,222,000	+ 7.1	10,246,000	—38.4	46,521,000	— 4.0
1926	41,311,000	+ 2.7	9,399,000	— 8.3	53,207,000	+14.4
1927	41,888,000	+ 1.4	6,782,000	—27.8	62,919,000	+18.3
1928	41,336,000	— 1.3	7,126,000	+ 5.1	77,174,000	+22.7

Average Consumption of Coal per Kilowatt-Hour by Public-Utility Power Plants in the United States, 1919-1928

Year	Output by the Use of Fuel (Coal, Oil, and Gas)* — Kilowatt-Hours	Change from Previous Year (Per Cent)	Consumption of Coal and Coal Equivalent of Other Fuels — Total — Net Tons	Change from Previous Year (Per Cent)	Per Kilowatt-Hour — Pounds	Per Cent of Rate in 1919
1919...	24,175,000,000	.....	38,880,000	.....	3.2	100
1920...	27,248,000,000	+12.7	41,420,000	+ 6.5	3.0	94
1921...	25,863,000,000	— 5.1	35,240,000	—14.9	2.7	84
1922...	30,234,000,000	+16.9	38,000,000	+ 7.8	2.5	78
1923...	36,088,000,000	+19.4	43,522,000	+14.5	2.4	75
1924...	38,808,000,000	+ 7.5	43,130,000	— .9	2.2	69
1925...	43,264,000,000	+11.5	44,780,000	+ 3.8	2.1	66
1926...	47,274,000,000	+ 9.3	45,856,000	+ 2.4	1.95	61
1927...	49,995,000,000	+ 5.8	45,910,000	+ .1	1.84	57
1928...	52,733,000,000	+ 5.5	46,434,000	+ 1.1	1.76	55

*Not including output by use of wood.

equivalent to about $8,000,000. In 1919 the average rate of coal consumption in generating electricity was 3.2 lb. per kilowatt-hour. The rate of 1.76 lb. for 1928 is therefore very close to half the 1919 rate. If coal had been consumed by electric public utilities at the rate of 3.2 lb. per kilowatt-hour in 1928 the increase in fuel consumption would have been about 38,000,000 tons, representing about $150,000,000.

The information in the accompanying tables is based on the figures of production of electricity as previously published in the regular monthly power reports by the Geological Survey, Department of the Interior. The output of central stations, both commercial and municipal, which together contribute over 94 per cent, and electric railway plants is included in these monthly reports.

The tables show the output and fuel consumption for 1927 and 1928 for the United States and its main divisions, with the annual figures of output and fuel consumption and the average rates of fuel consumption per kilowatt-hour from 1919 to 1928. The figures for 1928 are preliminary and are subject to revision.

A final report which will give the total output of each state for 1928 will be published some time in April and will include revisions of previously published figures due to the receipt of data after the release of the monthly reports. The revisions for the most part are slight and changes in the totals for the entire United States are generally only small percentages.

Finding and Encouraging Competent Men for Scientific Research in Industry*

By Dr. F. B. Jewett
Vice-President American Telephone & Telegraph Company
President Bell Telephone Laboratories, Inc.

"EXCEPT in those details which are the direct consequence of a particular function, the problem of finding and encouraging competent men in industrial research is in no substantial measure different from the finding and encouragement of competent men in any walk of life."

* * * *

"The rank and file of the modern industrial research organization are relatively easy to find, though sometimes difficult to get in sufficient numbers."

* * * *

"A man is essentially miscast and essentially a transient if he finds himself in a field of endeavor where the primary requisite for success is alien to the thing he most desires."

* * * *

"In both pure science and industrial research the men who succeed will be, for the most part, those men in whom the element of curiosity about nature and her ways is a controlling urge."

* * * *

" . . . the problem of finding competent men boils down, in the last analysis, to our ability to find competent young men—to bring them into the organization, provide them with the facilities and encouragement for growth, and ultimately to make leaders of them."

* * * *

" . . . when competent men come to us we can see to it that their surroundings, the conditions of their association with their fellows, and the tools with which they work are congenial and adequate. Above all, we must see to it that a just recognition of their achievements is accorded them."

**Excerpts from recent speech before the American Association for the Advancement of Science.*

Most Economical Conductor

Dollar evaluation of transmission line conductors based on Kelvin's law. Load factor and line constants combined. Graphs and illustrative examples

By J. G. TARBOUX
Assistant Professor of Electrical Engineering Cornell University

THE fundamental principle of this paper on the economical transmission line conductor is based upon Kelvin's law and may be stated as follows: "The most economical area of conductor is that for which the ***annual cost of energy wasted*** is equal to the ***yearly fixed charges*** on that portion of the capital outlay which can be considered as proportional to the conductor area."

Transmission Line Costs as a Function of Conductor Area.—By detail computations determine the cost of the transmission line in place for varying sizes of conductors. This must be done for the particular location under investigation and for a particular voltage and type of structure. In the case of most systems the voltage and type of structure are dictated by other conditions than the conductor to be used, mainly the desirability of standards. The method outlined below assumes, therefore, a knowledge of the voltage and of the type of structure to be used. The results of this type of analysis for a 110-kv. line with wood H-frame supports are shown in Fig. 1. It will be noticed that the points plotted are practically in a straight line and it is the opinion of the writer that Fig. 1 can always be taken as a straight line.

It is now possible to express the initial cost of the transmission line by the following equation:

$$\text{Cost} = D + aA \text{ dollars per mile} \qquad (1)$$

where D = that part of the cost which is independent of conductor area.
a = the slope of the cost line.
A = the conductor area in circular-mils.

The variable part of the transmission line cost

$$= aA \text{ dollars per mile} \qquad (2)$$

And the annual fixed charges upon this cost

$$= aAF \text{ dollars per mile} \qquad (3)$$

where F is the rate of fixed charges.

Power Loss.—The power loss over the three conductors of a three-phase line is

$$\text{Loss} = \frac{3I^2R}{1{,}000} \text{ kw. per mile} \qquad (4)$$

Where R = Resistance per mile of conductor in ohms.
I = Current flowing in each conductor.

For short lines it is permissible to consider the current as constant throughout the entire length of line; however, for long lines this is not the case. The capacity current of the line becomes of importance particularly for line voltages over 110 kv. Further, the effect of the charging current varies widely with the power factor of the receiving end of the line.

For this reason this study is given in two parts, namely: Part I, short lines. Part II, long lines.

PART I, SHORT LINES—CAPACITY NEGLECTED

The power loss per mile

$$= \frac{3I^2R}{1{,}000} = \frac{3I^2\rho}{1{,}000A} \text{kw.} \qquad (5)$$

where ρ = Resistance per mile per circular-mil.
A = Conductor area in circular-mils.

Equation (5) holds true for only one value of current; however, in the actual case the current delivered by a line is very variable and is a function of the load factor.

S. M. Jones and J. Tompkins of the Alabama Power Company

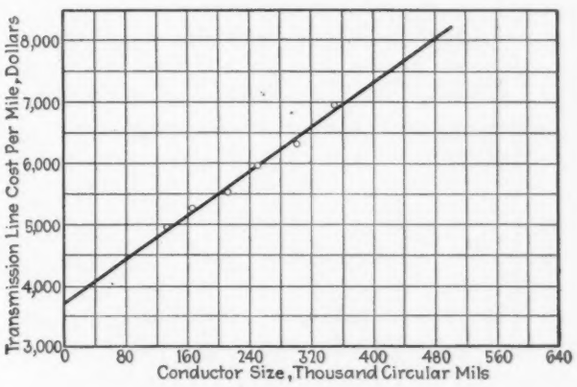


Fig. 1—Transmission line cost

Single-circuit, 110-kv. line, wood H-frame with copper conductors.

have made a very extensive study of this current variation and have arrived at the following result:

Yearly kilowatt-hour loss = kilowatt loss max. $\times C$ (6)

where C is given by Fig. 2 as a function of load factor. Kilowatt loss max. refers to the line loss with maximum current flowing. This result was obtained by computing the yearly kilowatt-hour loss for a large number of load curves at different load factors. The values of C obtained from this study were then plotted against load factor.

It is now possible to write the equation for yearly energy loss per mile as follows:

$$\text{Kilowatt-hour loss} = \frac{3I^2\text{max.}\rho CV}{1{,}000A} \text{ dollars} \qquad (7)$$

where V = value of energy loss in dollars per kilowatt-hour.

Equating the value of yearly energy loss to the annual fixed charges on the variable part of the transmission line cost, and then solving for A, the conductor area in circular-mils, we get:

$$A = \frac{Kva}{E}\sqrt{\frac{\rho CV}{1{,}000aF}} \text{circular-mils} \qquad (8)$$

where E is the line voltage in kilovolts.

The above equation is fundamental and can be used for any conditions by properly evaluating the several coefficients.

It was found that by plotting $\sqrt{C}$ (see Fig. 2) against load factor a straight line was obtained for load factors above 20 per cent. Since the annual load factors are generally above 20 per cent it becomes possible to state the variation of the constant C as follows:

$$C = 9 + 0.8459K \qquad (9)$$

where K = load factor in per cent (Fig. 2).

It is now possible to compute the most economical size of conductor for any annual load factor, once the value of ρ, C, V, a and F are known.

In Fig. 3 is given the results of equation (8) for a 110-kv., single-circuit line of copper conductors and wood H-frame supports and constants as follows:

$\rho = 59{,}200$ ohms per mile per circular-mil at 42 deg. C, which was taken as a yearly average temperature of the conductors.
$V = 0.0045$ dollar per kilowatt-hour.
$a = 0.00895$ for 110-kv. lines. (See Fig. 1.)
$F = 0.08$

Part II, Long Lines—Capacity Considered

Problem.—The problem involved is to obtain the equation of the average current squared which flows along a line. Having this average current squared, it then becomes possible to determine the power loss in the line by equation (5).

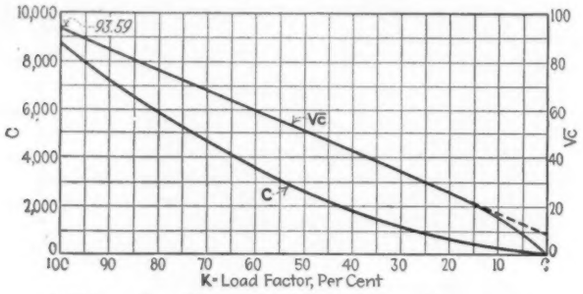


Fig. 2—Yearly line loss diagram

$\sqrt{C} = 9 + 0.8459k$.
K = Load factor in per cent.
Yearly kw.-hr. loss = Kw. loss max. $\times$ C.

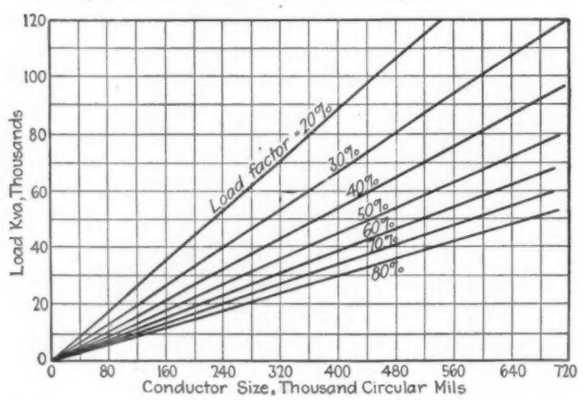


Fig. 3—Most economical conductor size

Single-circuit, 110-kv. line, wood H-frame with copper conductors.

The fundamental equation of current at any point along a transmission line conductor is:

$$i = I \cosh ms + EY_o \sinh ms \qquad (10)$$

Where $I = I_1 + jI_2$ = receiver end current.
E = phase voltage in volts at receiver end, taken as the reference vector.
$ms = (\alpha + j\beta)\, s$ = hyperbolic angle of the line.
s = distance in miles from receiver end.
$Y_o = c + jd$ = surge admittance of the line.
Cosh ms = Cosh αs Cos βs + j Sinh αs Sin βs.
Sinh ms = Sinh αs Cos βs + j Cosh αs Sin βs.

The following simplifying assumption was made at this point, namely:

Sinh $\alpha s = \alpha s$
Cosh $\alpha s = 1$

This was done after finding that this was approximately true for a line as long as 300 miles; the error involved is only a small fraction of 1 per cent. Therefore:

Cosh ms = Cos $\beta s + j\, \alpha s$ Sin βs
Sinh $ms = \alpha s$ Cos $\beta s + j$ Sin αs $\qquad (11)$

Solution.—The actual solution is based upon equation (10) with the simplifying assumption of equation (11). The actual work is not given in this paper, but the procedure is as follows:

1. Expand equation (10) by introducing all complex terms.

2. Separate out all real and imaginary terms so that equation (10) is arranged in the following form:

$$i = a + jb.$$

3. Since only the magnitude of i is desired, without reference to phase relation, it follows that:

$$i^2 = a^2 + b^2.$$

This gives a simple algebraic equation without complex notation, and furthermore gives the law of variation of the current squared as a function of the distance from the receiver end, or mathematically

$$i^2 = \int(s) \qquad (12)$$

4. To obtain the average current squared integrate equation (12) between the limits "o" and "S" and then divide through by "S," or mathematically

$$\text{Average } I^2 = \frac{1}{S}\int_o^S i^2 ds \qquad (13)$$

The result of this procedure leads to the following formula:

$$\text{Average } I^2 = K_1E^2 + K_2I^2 + K_3EI \qquad (14)$$

where

$$\left.\begin{aligned} K_1 &= \frac{Y_o^2}{2}\left[\frac{a^2S^2}{3} + 1 + \left(\frac{a^2S}{2\beta} + \frac{p}{S}\right)\text{Sin } 2\beta S + \frac{a^2}{2\beta}\text{Cos } 2\beta S\right] \\ K_2 &= \frac{1}{2}\left[\frac{a^2S^2}{3} + 1 - \left(\frac{a^2S}{2\beta} + \frac{p}{S}\right)\text{Sin } 2\beta S - \frac{a^2S}{2\beta}\text{Cos } 2\beta S\right] \\ K_3 &= \left[\phi a S + \tau\left(\frac{a^2S}{2\beta} + \frac{p}{S}\right)\text{Cos } 2\beta S - \frac{\tau a^2}{2\beta}\text{Sin } 2\beta S - \frac{\tau p}{S}\right] \end{aligned}\right\} \qquad (15)$$

Neglecting the shunt leakage of the line we have:

$$\left.\begin{aligned} &\alpha = \frac{b}{2}(z - x) \qquad \beta = \frac{b}{2}(z + x) \\ &Y_o^2 = \frac{b}{z} \\ &p = -\left(\frac{a^2}{4\beta^3} + \frac{1}{2\beta}\right) \\ &\phi = c\,\text{Cos }\theta + d\,\text{Sin }\theta \qquad \tau = c\,\text{Sin }\theta - d\,\text{Cos }\theta \\ &c = \frac{\beta}{z} \qquad d = \frac{\alpha}{z} \end{aligned}\right\} \qquad (16)$$

θ = Power-factor angle
= — for lagging current
= + for leading current
z = Impedance per mile in ohms
x = Reactance per mile in ohms
b = Susceptance per mile in mhos

An inspection of equations (15) and associated coefficients will show that the conductor resistance does not enter as an independent term; it is always embodied within the impedance. It is now necessary to evaluate the reactance, impedance and capacity susceptance so that these equations may be useful for any voltage within a working range and also for any conductor size.

In Loew's Electric Power Transmission, page 260, there is found an article with this heading: "Reactance and susceptance per mile of line relatively independent of conductor diameter and line voltage." The author then proceeds to prove the above statement. Briefly, this is true because the voltage determines the conductor spacing and conductor spacing and radius appear in the following form within the equations of reactance and susceptance:

$$\log \frac{D}{R} \qquad (17)$$

where D is the spacing and R the conductor radius. D and R may vary considerably without causing very much variation in the reactance and susceptance.

Professor Loew then works out the following values for reactance and susceptance per mile for 60 cycles:

$$\left.\begin{aligned} x &= 0.8 \text{ ohm} \\ b &= 5.3 \times 10^{-6} \text{ mho} \end{aligned}\right\} \qquad (18)$$

which are fairly constant independent of voltage and conductor size.

The impedance is given below:

$$z = \sqrt{r^2 + x^2}$$

The reactance x is fixed; r may vary between 0.4 and 0.1 ohm per mile for conductors between 00 and 600,000 circular-mils. The impedance will then vary between the limits 0.89 and 0.81 ohm for the same range of conductor size. For estimating purposes such a small difference can be neglected and therefore the impedance can be considered as constant, independent of conductor size. An average value is taken, namely:

$$z = 1.06\, x \qquad (20)$$

It is now possible to evaluate the coefficients K_1, K_2 and K_3. These constants for 60 cycles are shown plotted in Fig. 4.

To check the accuracy of equation (14) a typical example of a 200-mile line was taken, the losses being computed by the difference in sending and receiver powers and also by the use of equation (14). The results by these two methods checked within 1.5 per cent, which is considered very good for this type of problem.

The yearly energy loss can now be computed as

$$= \frac{3\rho S \times 8{,}760}{1{,}000A}(K_1E^2 + K_2I^2 + K_3EI) \text{ kilowatt-hours} \qquad (21)$$

Equation (21) shows that the total energy loss is equal to the sum of three items; one proportional to voltage squared, one proportional to current squared and the third to the first power of the product of voltage and current.

However, the energy loss due to the load current should embody the load factor coefficient C, see Fig. 2. If I_m be the maximum load current, it is easily shown that

$$I = \frac{\sqrt{C}}{93.59} I_m \qquad (22)$$

Substituting (22) into (21) and also replacing E, the phase voltage in volts, by E_r, the line voltage in KV, we get the final form for yearly energy loss, namely:

$$\text{Yearly energy loss} = \frac{S}{A} M \qquad (23)$$

$$\text{where } M = NE_r^2 + \frac{P}{E_r^2} W^2 + QW \qquad (24)$$

$$W = \sqrt{C} \times Kva$$

$$Q = Q_1 \text{Sin } \Theta + Q_2 \text{ Cos } \Theta$$

The coefficients N, P, Q_1 and Q_2 are plotted against length of line in Fig. 5.

The annual value of energy loss

$$= \frac{S}{A} MV \text{ dollars} \qquad (25)$$

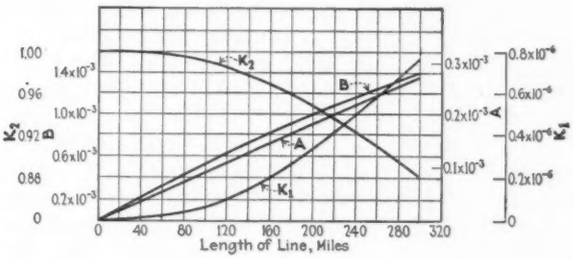


Fig. 4—Transmisison line current diagram, 60 cycles

$I_{avg}^2 = K_1E^2 + K_2I^2 + K_3EI$
$K_3 = A \text{ Sin } (\Theta + 80.3) + B \text{ Sin } (\Theta - 9.7)$
Θ = Receiver power factor angle; minus for lagging, plus for leading current.

The fixed charges on the variable transmission line cost

$$= a\,ASF \text{ dollars} \qquad (26)$$

Equating (25) to (26) and solving for A we get the most economical conductor area, as follows:

$$A = \sqrt{\frac{MV}{aF}} \text{ Circular-mils} \qquad (27)$$

Substituting the values of V, F and a as previously assumed we get:

$$A = k\sqrt{M} \text{ Circular-mils} \qquad (28)$$

where $k = 2.5$ for 110-kv. line, wood H-frame, copper conductors.

Results of Formula Use

In Fig. 6 is shown the results of the application of these methods for 110-kv. lines and for a receiver power factor of unity. These curves are plotted between area in circular-mils and the product $\sqrt{C} \times KW$, the constant $\sqrt{C}$ being obtained from Fig. 2 for the particular load factor under consideration and the KW referring to the maximum demand at the receiver end. A curve is also plotted according to equation (8) which gives the most economical area of conductor according to the approximate method, neglecting capacity.

The difference in conductor areas as obtained by the two methods is not very large for the case of the 110-kv. line. This difference is more pronounced in the case of the 154-kv. line, particularly for the longer lines. It is certainly clear that for lines of less than 50 miles length the approximate method is absolutely satisfactory.

The results given by Figs. 3 and 6 are true only for the value of energy loss, rate of fixed charges and transmission costs as assumed. An inspection of equations (8), (27) and (28) will indicate that the conductor area varies directly as the quantity

$$\sqrt{\frac{V}{aF}} \qquad (29)$$

which includes the above variables. Therefore, it is possible to use Figs. 3 and 6 for any other combination of the above three variables by properly correcting the scale of conductor sizes.

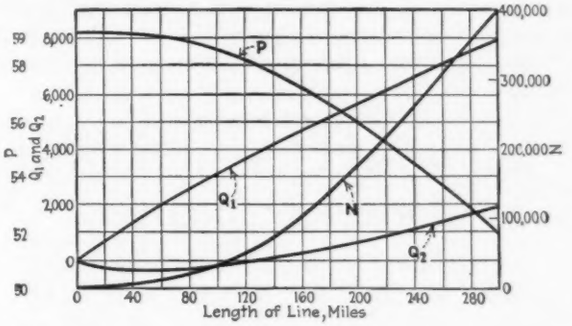


Fig. 5—Transmission line loss diagram

Single-circuit, 110 kv. line, wood H-frame, 60 cycles, with copper conductors.

Energy loss per year $= \frac{S}{A} M$ kilowatt-hours

Most economical conductor area $= 2.5\sqrt{M}$ circ.-mils.

$M = NE_r^2 + P\frac{W^2}{E_r^2} + QW.$

$Q = Q_1 \text{ Sin } \Theta + Q_2 \text{ Cos } \Theta.$

$W = \sqrt{C} \times$ kva.

S = Length of line in miles.

A = Conductor area in circular-mils.

E_r = Receiver line kilovolts.

Θ = Receiver power factor angle; minus for lagging, plus for leading current.

$\sqrt{C}$ = Load factor correction (Fig. 2).

kva at receiver.

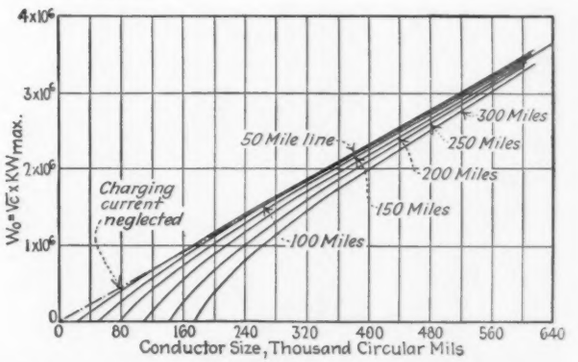


Fig. 6—Most economical conductor area

Single-circuit, 110-kv. line, wood H-frame, 60 cycles, using copper conductors and with receiver power factor 100 per cent. Note: $\sqrt{C}$ is obtained from Fig. 2.

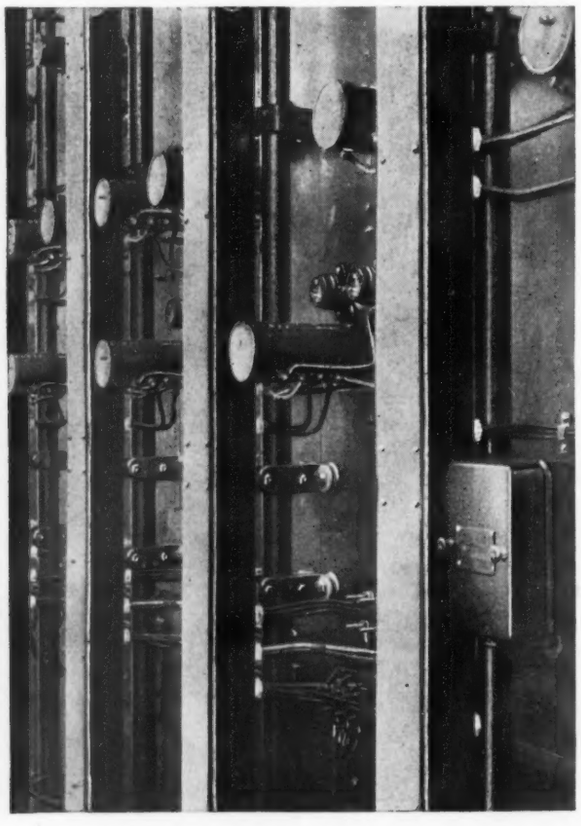
The accurate solution for long lines has another important application which is probably of greater value than the results obtained for most economical conductor area. By means of equation (14) and Fig. 5 it is possible to obtain the value of average current squared for any length of line up to 300 miles. It is then possible to obtain the power loss with any size of conductor by use of equation (5). If computations for the most economical conductor area are made it then becomes possible to obtain the yearly energy loss by equation (23).

The work of the accurate solution is based on a known receiver end power factor. In the case of a long line where synchronous condensers are used, thereby maintaining constant voltage at the two ends of the line, the receiver power factor is not an independent variable, but is a function of the sending voltage, receiver voltage, load and also constants of the line. In other words, it is fixed by the circle diagram constants of the line. The author has found that it is possible, through the circle diagram relations as given by Evans and Sels and also with the assumptions made in equations (18) and (20), to obtain an expression for the receiver power factor angle in terms of the sending and receiver voltages and the load in kilowatts. This is, however, of greater academic interest than it is useful for estimating purposes.

Improved Control Wiring for Switchboards

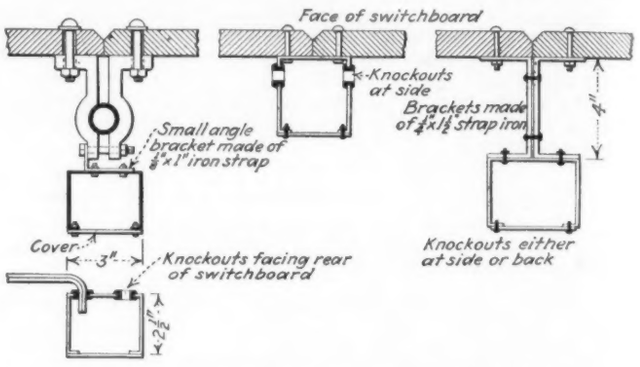
By Trevor A. Robinson
Engineering Department,
City of Winnipeg Hydro-Electric System

IN NO part of the station does neatness and appearance count for more than in the switchboard design. The wiring at the rear always presents a difficulty, especially so if a system of master relays, or other scheme involving a great deal of wiring, is used. To overcome this congestion and to keep the wires free from exposure and dust the method shown in the accompanying illustration was worked out. This consists of a vertical wiring trough, supported on the pipe framework behind the switchboard. Knockouts are provided facing the board and wires are brought out opposite the apparatus to which they are connected. This keeps the back of the board practically free from wires, except for those horizontal runs from trough to apparatus. The trough is made of light steel construction and serves purely as a container for the wires.



Wiring trough on back of switchboard

A further development of this scheme would be to eliminate the pipe framework, using the troughs as supports. Such an arrangement is shown in the drawing, where the board is mounted directly on the trough and the wires are brought out at the side. This would give a very neat appearance, but would, by covering up the edge of the board, cut down its useful width. To overcome this difficulty the board could be held at a short distance from the trough by brackets, as shown in the sketch, thus permitting apparatus to be mounted close to the edge of the board. With the trough in this position the knockout could be either at the side or back, depending upon the type of apparatus which is mounted on the switchboard.



Trough mounted on pipe supports at left and the idea further developed center and right

5,000,000 Lamps Sold in Thirty-Day Campaigns

AS A result of intensive sales effort by the employees of 73 central stations participating in the 1928 empty socket compaign sponsored by the Edison Lamp Works more than 5,000,000 Edison "Mazda" lamps were sold. The average wattage of lamps sold was 56 and the potential total load increase gained by all participating companies is, according to J. W. Milford of the Edison Lamp Works, 280,000,000 kw.-hr.

The activity was carried out on properties serving 3,454,000 residential meters and average sales were 1.2 lamps per meter. A few companies averaged over two per meter, while some sold three and four as a result of particularly intensive sales efforts.

The general plan of all the campaigns was essentially the same. Employees were enlisted to sell cartons of lamps on commission, generally of 25 cents per carton. Lamps were delivered by the company and charged on the customer's electric service bills. Cartons of 60-watt lamps were featured by most companies, but in a number of instances a special assortment of 40-, 60- and 100-watt lamps were offered. Practically all campaigns were conducted on a basis in which competition between groups of employees, departments and properties of each company was encouraged. Special prizes were also awarded by the majority of the organizations which participated in this 1928 empty socket campaign.

The Why and How of
Installment Merchandising

Successful time-payment policy on sale of electrical products, as on any other product, is predicated on observance of certain fundamental principles

By H. Bertram Lewis
Vice-President Commercial Credit Company

WHEN American industry found itself capitalized for war production but with no longer a war on its hands it had to make some rapid readjustments. New domestic buying power had to be developed to absorb an adequate share of its potential output. New markets had to be opened up abroad. And every instrumentality that was capable of lending a hand to either process had to be utilized.

The manufacturer of products with high unit value found ready to his hand a tried and proved stimulant of the domestic market. He had seen manufacturers of pianos, furniture and such household utilities selling for years on installment terms with obvious gain as to volume and with no undue proportion of loss.

H. B. Lewis

The automobile manufacturer had even ventured upon that expedient himself before the war, and what little he had done with the idea prior to its outbreak had convinced him of the value of the principle. It was, of course, logical that he should utilize it to the utmost toward the solution of his post-war problem and that his lead should be followed by domestic utility manufacturers in general.

Therefore the period 1918-1929 has seen a development of that principle on a wholly unprecedented scale, a considerable amount of viewing with alarm by economic experts of conservative mentality and a sturdy rebuttal of their position by other economists whose analyses of the figures has convinced them that no undue hazards are involved so long as the methods used adhere to certain well-established standards.

It is pointed out by the latter school of commentators —today much the more numerous and authoritative of the two—that the crux of the situation is not the volume of installment paper discounted within a given period, but the average amount outstanding during that period, and that this figure is not and has never been excessive. Milan V. Ayres in his most comprehensive study of the subject, presented to the National Association of Finance Companies in 1926, estimates the total outstandings of such paper, for merchandise purchases of all kinds in that year, as $2,638,000,000, which is less than 4 per cent of our estimated national income of $70,000,000,000 for the same period, and certainly nothing to worry about so long as the delinquency figures continue moderate, as they are today and always have been since the inception of the business.

And the total is probably not greatly in excess of that figure today, for the source of its greatest growth from 1918 to 1926 was the automotive industry, whose percentage of time paper increased by leaps and bounds from 1918 to 1923 and at a less geometrical rate from 1923 to 1925, since which time it has been decreasing, and whereas the ratio of installment sales for new and used passenger cars was 65.5 per cent in 1925 it was but 59.5 per cent in 1928. The total domestic passenger car sales of the industry were less in 1928 than in 1926, though the total output was greater, the average being absorbed by the foreign market, with which we are not concerned in this discussion. Therefore, the total new and used passenger car financing in this country has definitely decreased since 1926 and it is a question whether installment sales in other lines have increased enough to balance, let alone exceed, this loss.

The discrepancy between the total time sales and the maximum amount outstanding is quickly visualized when the effect of the down payment and successive regular monthly payments is considered. Let us view the motor industry for 1928 as an illustration. Its total domestic retail sales of new and used passenger cars were doubtless in the neighborhood of $4,000,000,000, of which 59.5 per cent were installment transactions. This means that, in round figures, some $2,400,000,000 worth of new and used cars were sold on time. The average down payment undoubtedly exceeded 33⅓ per cent, for that is the minimum accepted by the better class of finance companies on new car transactions and 40 per cent is the minimum on used car transactions. For simplicity in figuring we will use the former percentage, however, which, deducted from $2,400,000,000, leaves us with $1,600,000,000 advanced on deferred payments. To this sum the finance companies would add their carrying charges of approximately 10 per cent, making a gross advance to consumers of $1,760,000,000. This sum would, of course, not all go on the books at once. Each month would put something on and each month

after the first would take something off. The average automobile installment contract runs for ten months, all classes of paper considered, which means that beginning with the eleventh month the monthly payments will equal the charges per month of the ten months preceding if these have been of equal amount and that the highest amount outstanding at any one time will not exceed 33 per cent of the total time sales nor 46 per cent of the total deferred balances. Furthermore, if installment selling had stopped abruptly at the end of the year these outstandings would within four months have been down to less than 12 per cent of the total time sales and about 17.5 per cent of the total deferred payments. In round figures the maximum outstandings would have been in the neighborhood of $800,000,000 only, on $4,000,000,000 total business and $2,400,000,000 time sales.

Of course, time sales do not hold to a uniform monthly figure throughout the year, but these totals and percentages would not be greatly modified by their variations.

Substitute for Other Forms of Credit

Another important conclusion reached by the most intelligent students of the subject is that a considerable proportion of this installment credit is not credit which would never have been extended except for the introduction of the installment system into the economic scheme of things, but credit which would have taken the form of open account or single-maturity note transactions. And as between those classes of credit and installment credit the loss figures are by no means to the disadvantage of the latter system. In fact, the Standard Statistics Company, which made a study of this very question during 1926, reported in a bulletin issued during November of that year that the automobile installment loss figures of 50 large finance companies for a one-year period had shown a more favorable ratio than the open account loss figures of department stores, dry goods stores, retail jewelers and retail grocers, being but approximately one-sixth of the department and dry goods store ratios, one-third of the jewelers' ratios and one-half of the grocers' ratios.

"The crux of the situation is not the volume of installment paper discounted within a given period, but the average amount outstanding during the period, and this figure is not and has never been excessive."

The installment basis is unquestionably safe if proper limits as to down payment and terms of the deferred balance are imposed, if credit methods are efficient and if the collection work is both thorough and intelligent. A down payment that does not give the buyer sufficient equity in the product to penalize him heavily in case of default, and so limit the seller's equity that in case of repossession he can resell without loss, is insufficient. Nothing, in fact, is more essential to the sound application of the installment principle than an adequate down payment. The terms of payment for the deferred balance are only a shade less important. The buyer's equity builds up and the seller's decreases in proportion to the rate of payment and, of course, each installment paid adds just so much to the buyer's incentive for going through with the transaction and decreases the seller's prospect of loss in the event of repossession and resale.

Intelligent credit selection is obviously fundamental and requires a technique peculiar to the installment field. Not infrequently an applicant is approved for this class of business who would not qualify under the generally accepted standards for open account credit, the difference being that his installment account is secured by retention of title to the merchandise and that he has special inducements to pay his balance in order to salvage his substantial down payment. Also, that few people who have experienced the convenience of using such desirable utilities as alone are suited to this merchandising method will ever give them up if they can acquire full title to them.

Generally speaking, the moral risk and the indications of permanency as to location, employment, etc., are the first factors to be considered, and where these are favorable and the record shows no prior instance of credit abused, the basis is considered sound if the amount of the monthly installments involved does not represent an undue proportion of the purchaser's income. The experienced installment credit man develops a sixth sense which becomes his chief reliance—and a very dependable one—in sizing up the doubtful cases. Not infrequently average experience with a certain product, average experience with buyers in a certain industry or buyers who live in a certain location or buyers of some particular race is a determining factor, and not a few rejections are based on a balancing of these factors even where no clearly defined obstacles have appeared. Acceptances, too, are often founded on similar intangible considerations which trace back to prior experience and whose weight can only be appreciated by men of long training in this highly specialized field. The same sixth sense smells out such elusive hazards as that presented by the bootlegger, who is often impossible to identify definitely, but whose occupation is generally suggested by certain dependable indications which only the installment credit man of long training has a quick nose for.

The art of installment collection work is not in oppressive methods, but in a closely sustained method of follow-up. It requires thorough organization and an airtight system of control. The delinquent must be instantly aware that he has slipped and that you know it. He must be worked on gently but indefatigably until his overdue installment is collected. If gentle methods fail, the property must be repossessed just as soon as the seller is satisfied that payment will not be forthcoming. But usually where polite but gentle pressure is unremittingly maintained extreme measures are unnecessary. Where installment collectors are rough it usually signifies that their methods are slipshod.

Installment rates are not interest and must never be confused with interest in the public mind. They represent the cost of a service in which interest on the money is only one of many factors. The figures usually include insurance. Always they include the cost of credit and collection work, legal expenses, if any, occasional repossession costs with provision for the expenses of resale, reserves against normal losses, with a margin for the unexpected, office overhead and management, with a percentage included for profit. In proportion to their costs, finance company rates are exceedingly low. Most of them include a 2 per cent profit margin, but very few finance companies have ever averaged that percentage on their turnover for a period of years. Their earnings on capital have generally been less than those of successful manufacturers or merchants, though an

adequate return has been made by all those that have been soundly managed.

Installment merchandising may be considered as characteristic a product of our present industrial age as radio, the motor vehicle, the tractor, the electrical household utility, aircraft, the Diesel engine, or the steam shovel. It has come into general use because the economics of the situation required a more elastic form of credit than either the open account or the single-maturity note, embodying special factors of security not present in either of these others. It will remain an essential part of our merchandising system just so long as it is needed, and while the present sound standards continue to govern its use it will prove indispensably valuable and extraordinarily safe.

Airway Guides and Markers

By O. W. Bard
Illuminating Engineer Public Service Company of Northern Illinois

WE HAVE marked our streets and highways and numbered our houses. Now it is time to mark our airways and identify our municipalities. Airway markers are not only a straight business proposition of advertising, but they are also lighthouses of safety at night. By the use of proper color combinations roof signs can be made distinguishable from the surrounding lights of the city.

Two markers have been completed by the Public Service Company of Northern Illinois. At Joliet a sign was constructed on a building roof with the letters of the word "Joliet" made of concrete blocks 12 ft. in height and raised 3 in. above the surface of the roof. The stroke of each letter is approximately 2 ft. wide and directly in the center is a row of 40-watt lamps on 12-in. centers. They are inclosed in vapor-proof fittings with amber-colored globes. The letters are painted in the regulation chrome yellow of the Department of Commerce and the surrounding roof surface is black. A directional arrow is provided to indicate a true north direction. This marker is located in the heart of Joliet's business district upon a building floodlighted in color and surrounded by a number of large neon displays. The distinctive color of the marker overcomes the competition of the street lighting and electric advertising signs and gives it good visibility.

Aviation market and obstacle lights on large gas holder

Its effectiveness in all kinds of weather is assured by the construction used. The upright vapor-proof fittings extend above the letters 9 in., making a total height above the surface of the roof of 12 in. It is expected that the heat of the lamps will rapidly melt the snow surrounding them when entirely covered, although such a snowfall seldom lasts very long in this region.

The directional sign on the roof of the Maywood gas holder of the Public Service Company of Northern Illinois is one of the largest near Chicago. The arrow pointing to the Chicago municipal airport is 150 ft. long. The smaller arrow indicates the true north direction and is the standard symbol used on airways. This sign is painted in chrome yellow directly upon the steel plates of the top of the holder. The remainder of the roof is painted black. Illumination is provided at night by twenty-six 200-watt floodlights with rectangular distribution lenses and especially designed hoods. These hoods serve a dual purpose. First, they cut off all upward rays of light so that no direct light can blind a pilot flying over the holder at night, and second, they provide added obstacle lights. This is accomplished by inserting a red bull's-eye in the center of each of the lamp hoods.

Aviation marker on roof of Public Service Building

On account of the location and the size of this holder, unusual precaution was taken to insure its visibility in bad weather. Possibly the lighting appears overdone in clear weather, but every light is necessary when snow or fog forces the air mail down close to the ground. The holder is 320 ft. high and is one of the landmarks of the Chicago-Twin Cities airway. It is also on the edge of the transcontinental airway and within a mile of the Checkerboard flying field and the old Maywood air mail field. Thirty-three red flashing obstacle lights are used on the cap of the holder and around the four upper galleries. These are supplemented by 48 steady-burning white lights in vapor-proof fittings to illuminate sections of the holder and to give a perspective of its height. Prismatic globes are used on all fittings with 150-watt clear lamps. These globes give a powerful beam of light at an angle of 45 deg. with the horizontal, and some of them are mounted to give an additional horizontal beam visible for many miles on a clear night. These lights burn all night long and are a guide not only to pilots of the air mail, whose instinct guides them where others would be lost, but they are also a landmark for the community.

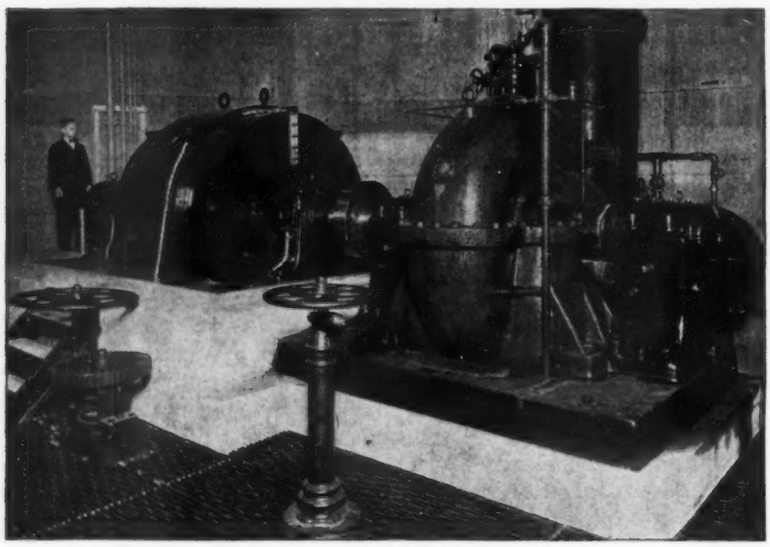
The value of an airway marker depends greatly upon its location, construction and legibility. Only standard, recognized symbols should be used. Simplicity should be adhered to always, for the pilot must be able to read its message in a fraction of a second. On a clear day there may be ample time to read an advertising sign and already manufacturing plants and warehouses are utilizing their large roof surfaces for this purpose. Before designing an airway marker, it is well to consult the Department of Commerce and the booklets published by the Aeronautical Division of that department. Valuable information and the latest approved methods of construction are given in these pamphlets.

Electric Pumping for Louisville Water Supply

THE Riverside pumping station of the Louisville (Ky.) Water Company, formerly steam operated, is now energized by a 13,000-volt transmission line of the Louisville Gas & Electric Company and all operations are performed electrically, according to V. C. Bailey, assistant to the general sales manager of the electric utility.

A thorough study of water supply requirements showed that the city's needs could be pumped in about eighteen hours per day, with a 60,000,000-gal. pump, and that with a pump of this capacity the pumping could be done when the power station's capacity would not be taxed with the industrial and commercial load. It was also found that most of the pumping could be done at night, when a great deal of surplus hydro energy would be available.

The pump is driven by a 13,000-volt, 2,500-hp. synchronous motor equipped with automatic starting and stopping control. Push buttons located close to the pump and also on the upper operating floor of the pumping station start and stop the unit. As a result of this simple control only one man is necessary for the operation of the unit.



2,500-hp. motor drives 60,000,000-gal. pump for municipal water supply

Sign Maintenance Schedule

By J. Hall Truman

Sioux City Gas & Electric Company, Sioux City, Iowa

THE illumination department of the Sioux City Gas & Electric Company has recently inaugurated a system of electric sign maintenance. This type of service is new in Sioux City, but merchants are rapidly appreciating its advantages. On account of inaccessibility, there is an easy tendency to put off from day to day cleaning and relamping a sign if the job is entirely up to the owner. With experienced men the utility can do this work quickly and cheaply.

The schedule that the company has undertaken consists of regular systematic inspection of signs, furnishing and replacement of all burned-out lamps at the time of inspection, washing the glass letters and face of the sign once every two months, repainting once each year, winding and setting of time clock control to compensate for the shortening and lengthening of the day, oiling and greasing of the flashing mechanism, or, in other words, a complete service at a small monthly charge which is added to the regular bill for electric service. This charge is based on the size of the sign and the number of sockets in it.

Refrigeration Represents a Major Load for Electric Utilities

PRODUCTION of ice in the United States during 1928 approximated 72,000,000 tons, of which 61,000,000 was manufactured. According to A. J. Authenrieth, vice-president of the Middle West Utilities Company, who emphasized the importance of refrigeration as an electric power load before the Mid-West Power Conference, the total number of ice plants is about 7,000. Of this number 32 per cent are steam driven, 59 per cent driven by electricity and 9 per cent use gas and oil engines. Assuming that the production divides itself according to the number of plants, then 19,500,000 tons was produced by steam, 36,000,000 tons by electricity and 5,500,000 tons by gas and oil. Using a figure of 62 kw.-hr. per ton, the total electric power used in ice manufacture in 1928 was 2,232,000,000 kw.-hr.

Cold storage is a large consumer of electric power, declared Mr. Authenrieth. On the basis of 731,377,000 cu.ft. of cold storage space in the United States, suming that electricity is used in the same proportion as in ice manufacture, namely, 59 per cent, and using the nominal rate of 60 kw.-hr. per 1,000 cu.ft. per month, the power for cold storage amounts to 310,688,600 kw.-hr. annually. In domestic and small commercial electric refrigeration 900,000 units are in use, he reported. At an annual consumption of 700 kw.-hr. per unit the local annual use of energy is 630,000,000 kw.-hr. In dairy, ice cream and other food process plants there are 17,993 electrical installations aggregating 159,720 tons of refrigeration. On a load factor of one-third these plants consume 584,575,200 kw.-hr. per year.

From the total of these estimates, listed in the table, it is apparent that an industry has grown up that is one of the best customers for electric service, if not the best. It consumes a large quantity of energy and makes no exactions of extraordinary service. From this tabulation one sees that the combined refrigeration demand offers greater potential load to the central stations than any other industry excepting the railroads and the whole field of steel making.

Table of Annual Energy Use of Refrigeration Applications

Cold storage	310,688,000
Ice making	2,232,000,000
Small electric refrigeration	630,000,000
Food processes	584,575,200
Total	3,757,263,200

Letters from Our Readers

Dancing Cables

To the Editor of the ELECTRICAL WORLD:

The article on "Dancing Cables," by W. K. Archbold, which appeared in the ELECTRICAL WORLD of January 26, is very interesting. A somewhat similar case came to my attention when I was connected with the firm of Gibbs & Hill, consulting engineers. One morning in March, 1917 or 1918, we were told that the 11,000-volt feeder wires along the Long Island Railroad were acting in a peculiar manner. Several of us went out along the right-of-way to witness the phenomenon. Truly, the cables were acting as if they had gone crazy, just as was remarked by Ray Henry upon another similar occasion. This was observed in the neighborhood of Woodside, L. I., where the railroad is by no means straight.

The conductors were of copper, a large number of them on steel towers with wooden arms and with pin type insulators. Some of the spans were parallel with the wind, some running diagonally and others at right angles to it. Those spans which were parallel with the wind or at right angles to it were absolutely quiet. They were as still as on a most beautiful June day. On other spans the wires were jumping all the way from a taut position above the insulators to the normal position. This movement was apparently entirely in the vertical plane. A careful scrutiny of it showed, however, that the movement was always slightly elliptical. The horizontal axis of the ellipse was so small in proportion to the vertical as scarcely to be noticeable.

No single span was jumping. There were always two or more adjacent spans showing this phenomenon. Certain spans would be jumping when adjacent spans of different length would be practically quiet. The whipping of the conductors with the corresponding movement across the top of the insulators loosened the ties upon many of the insulators. The wind was blowing steadily; that is, with practically no change in its characteristics from minute to minute. There were, however, regular pulsations in it. The beat of these pulsations was remarkably constant. There was a light mist, showing that the temperature was well above freezing.

There was undoubtedly a quite definite natural time period at which the conductor could be made to jump between the extreme positions described. This time period seemed to correspond exactly with the time necessary for a gust of wind to travel along the line diagonally from one span to the next. This gust in striking the first span would blow it sideways, drawing slack out of the next span beyond, over the top of the insulators. The gust then would travel to the next span and would jerk the slack out of the first one, causing it to jump upward. It is easily seen that if this movement were sufficiently violent it would make the first span jump all the way up into the taut position. If it would jump all the way up into the taut position it would be thrown violently backward to its approximate normal catenary position. Such a vibration would be practically without energy loss. The vertical movement then would be a transfer of wattless energy, speaking in electrical terms. The gusts striking the spans sideways at the same rate would supply the energy component. This energy component would be small in comparison with the wattless component and would be in the horizontal.

In stating the condition of the line I said that it ran high overhead along the right-of-way of the railroad. At some points the railroad passed through cuts, at other points over bridges. The dancing of the conductor seemed to be absolutely independent of the configuration of the land. In other words, the upward movement of the air, due to railroad cuts, etc., had nothing to do with the phenomenon. The energy was supplied by the horizontal air movements.

K. A. HAWLEY,
Chief Engineer.
Locke Insulator Corporation.

Standardized Power-Factor Metering

To the Editor of the ELECTRICAL WORLD:

My attention has been called to an error in the power-factor curve printed in my article in the December 22, 1928, issue of the ELECTRICAL WORLD on "Standardized Power-Factor Metering." In some unknown way the diagram sent to you for publication had a 10 per cent shift from our standard charts, which is much regretted. The abscissa scale of the chart as published should be shifted 10 per cent to the left so that for $R = 7.5$ the power factor is 13 per cent and for $R = 0$ the power factor is 100 per cent.

J. I. WHITNEY,
Superintendent Meter Department.
Vermont Hydro-Electric Corporation,
Rutland, Vt.

Plant Factor Favored

To the Editor of the ELECTRICAL WORLD:

In connection with your interesting editorial on "Load Factor," which appears on page 182 of the January 26 issue of the ELECTRICAL WORLD, might I carry the thought a little further and point out that as a matter of fact both we in Canada and you in the United States appear to have got into the erroneous practice of over and over again using this term "load factor" when we should use "plant factor," for instance, in statements to the effect that a plant of a given rated capacity with a certain load factor will have such and such an earning power, will require so much water, or will use so much fuel?

Reflection, however, will show that this is not correct, because, as you point out in your editorial, load factor is the relation of the average load to the maximum load; that is, it is not tied in any way or shape to the rated capacity of the plant, and therefore cannot be used to turn rated capacity into terms of either fuel consumption, water use or earnings. That this is true will be seen if one considers the case of two plants each rated at, say, 25,000 kw., one with a maximum yearly load of 28,000 kw. and an average of 18,200, the other with a maximum of 14,000 and an average of 9,100. The yearly load factors in both cases are 65 per cent, but the fuel consumption or the water use, and the earnings, would in one case be double those in the other, assuming equal efficiencies and similar rates.

On the other hand, "plant factor" does have a fixed connection with rated capacity, being by A.I.E.E. definition the ratio between the average load and the rated capacity, and so can be used to obtain the above quantities. I would therefore submit that it is the term which should be used in at least a large proportion of the descriptions, discussions, reports, etc., where the term "load factor" is now employed.

A. B. LAMBE.
Ottawa, Canada.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

A Russian Power Station.—C. J. WEBB.—It has been known for some time past that the Soviet government has been proceeding with a very comprehensive electrification scheme for which preliminary work was put in hand almost immediately after the revolution. The first development of any magnitude was the hydro-electric undertaking on the Volchov River, where a large generating station has been built to provide the electrical energy to meet the increasing industrial requirements of St. Petersburg, or Leningrad, as it is now known. The power station is designed for a total capacity of 80,000 hp. and the scheme embraces a set-up transformer station, a double transmission line to Leningrad and a primary step-down substation in that city, with six outgoing lines to the same number of secondary stations in which the voltage is further reduced for local distribution. —*Electrical Review (England)* February 22, 1929.

Methods of Choosing the Most Efficient Coal.—HOWARD W. MORGAN.—One of the most difficult problems for the buyer of coal is to decide which of the many competing coals offered is the most economical to buy. Some buyers base their decisions largely upon analyses. Others insist that only an evaporative test will determine the relative values. All are agreed that regardless of the price, the coal which will result in the lowest cost per unit of steam produced when labor, maintenance and ash disposal are included is the coal to use. Seven points should be kept in mind. They are: The analysis of coal is a good guide, but does not give the exact basis; freight cost a factor; unburned carbon is good coal going to the ash pile; determine approximately what the ash put loss will be with each coal; it is necessary to examine the influence of coal in the loss of heat up the stack; influence of amount of air, and a shovel full of coal should be put aside at various times during the unloading of a car if a representative sample is desired.—*Power Notes,* January-February, 1929.

Generation, Control, Switching and Protection

Armor-Clad Switchgear.—A. SCHNEEHAGE.—Electrical safety and a minimum of floor space, particularly in metropolitan areas, prompt continental European concerns to adopt the principle of the Reyrolle armor-clad switchgear in such modification as their particular requirements and safety codes demand. The present article describes constructions of a large German concern, suitable for medium voltage single- and double-bus, three-phase systems. The design embodies the usual withdrawal, interlocking and self-covering features, very similar to the original English arrangement. — *Elektrotechnische Zeitschrift,* January 31, 1929.

Transmission, Substations and Distribution

Features of Transformer Coils.—CHARLES A. ARMSTRONG.—There are a great many types of coil construction, methods of insulating and arrangement of oil ducts used in power transformers. About every form of coil has been used in transformer construction. They are made square, rectangular, round and elliptical, depending on the size and type of the transformer and on the inclinations of the designer. Conductors used in transformer coils may be insulated with a single cotton covering, a double cotton covering, paper, enamel or a single cotton covering over enamel. Enamel has a dielectric strength of 600 volts per mil and is therefore superior to fibrous insulation of the same thickness. In the larger transformers the problem of providing proper cooling facilities of the coils is an important one. To do this it is common practice to wind the coils in short thin sections with spaces between them. Another method of obtaining large coil surface exposed to the oil is to use circular disk coils. In other cases radial oil ducts are provided by suitable spaces between the disks of windings.—*Power,* February 12, 1929.

Flywheel Type Converters for Southwest Africa.—I. FINKELSTEIN.—Early in 1929 a flywheel type converter was supplied to southwest Africa for some mine work near Luderitzbucht. A description of a three-phase, 500-volt, 50-cycle converter for changing into 3,000 volts, 30 cycles, three-phase and designed so as to preclude current surges on the 500-volt network. For this reason a static transformer was installed, but the flywheel type converter was used.—*A.E.G. Progress,* February, 1929.

The Rupperswil Substation of the Swiss Federal Railways.—The Rupperswil substation is the largest substation of the Swiss Federal Railways. It constitutes the terminal point of the great north-south interlinking line erected by the Swiss Federal Railways in western Switzerland to interconnect their 132-kv., $16\frac{2}{3}$-cycle network. This substation is an outdoor one and has the advantage that it allows of better facilities for supervision, easy access to all apparatus, short duration of construction and nearly unlimited possibilities for subsequent extensions. There are two busbar systems, both on the 132- and 66-kv. side, corresponding to the two parallel single-phase, 132-kv. lines. The changing over of the lines and transformers from one busbar system to the other is done by means of double-pole isolating switches with operating gears. Both the 132- and 66-kv. busbar systems can be subdivided into three sections by means of isolating switches. Provision has been made for two transformers per busbar section. These transformers, which step down the voltage of incoming supply from 132 kv. to 66 kv., have each a continuous rating of 9,000 kva.—*Bulletin Oerlikon,* February, 1929.

Overhead Electric Lines. — W. B. WOODHOUSE.—The British Electrical and Allied Industries Research Association has undertaken a comprehensive research into the problems arising in the construction and uses of overhead electric lines. The research has been productive of valuable results. The present paper deals with two sections of the work: As to the strength of wooden poles, single and compound, and as to the intensity of wind pressures on wires and cables such as are used for overhead power lines and on the poles and lattice structures for supporting them. The tests on wooden poles disclosed a fundamental weakness in the design of compound poles and led ultimately to the development of a much-improved design. The wooden poles were tested under practical conditions. The information gained was supplemented by a series of tests on small-scale models, which confirmed the claims made for the greatly increased strength of new designs of compound poles. A series of experiments to determine the wind pressure on angle bars is described. The results indicate that the wind pressure on a fabricated frame may be estimated from the data obtained by tests on standard sections.—*Journal of the Institution of Electrical Engineers (England),* February, 1929.

Illumination

Survey of Neon Signs.—H. A. COOK.—No information has been available regarding the power factor, wattage consumption and general performance of neon signs. The results of tests taken in Detroit are given, making this information available for general use. Approximately two years ago activity in the manufacture and sales of neon signs in the territory served by the Detroit Edison Company was started. The acceptance of the form of advertising by merchants and industrial executives was so rapid and of such importance that it became necessary for this company to obtain information for its use in order to be in a position to determine the costs of operation, etc. An indication of the success of the effort put forth in the introduction of this advertising medium can be appre-

ciated when it is estimated that there are at the present time approximately 15,000 exposed and inclosed lamp signs in use and 600 neon signs installed and serviced.—*Transactions of the Illuminating Engineering Society,* February, 1929.

Lighting the Home for Special Occasions.—LILLIAN E. EDDY.—Lighting for purposes other than utilitarian is largely a new art created since the introduction of electricity as an illuminant, and the home, where decoration has always been a prime consideration, may use decorative lighting in a multiplicity of ways. Social functions represent an almost untouched field where special lighting may play a leading rôle in the temporary festive decorations. Such lighting is characterized by its simplicity of arrangement, assembly and construction.—*Transactions of the Illuminating Engineering Society,* February, 1929.

Motors and Control

Portable Dynamic Balancing Outfit.—PETER DAVEY.—During the past few years the general tendency to increase the speed of machinery has led to the development of methods of balancing which have greatly improved freedom from vibration. It is now expected of all high-grade machinery, regardless of size, that it shall operate smoothly at all speeds. Balancing machines in which rotors are balanced before mounting in their bearings are in general use. There are cases, however, where the balancing machine is not applicable, or is only partly applicable, and such cases can be classified under three main headings, which are: Cases where it is more expedient or quicker to balance the rotor after assembly, cases where the balancing machine has been employed, but some vibration still remains, and cases where troubles have developed after a rotor has been in service for some time. To meet the cases outlined the Davey dynamic balancing equipment has been developed.—*Iron Age,* February 28, 1929.

Heat Applications and Material Handling

Welding of Power Plant Piping.—F. G. OUTCALT.—Developments during recent years have reached the point where it is possible for the power plant engineer to treat welded construction exactly as he does other types, if he takes the necessary steps to secure high-quality results. He must consider the following points: Specifications of material and design; selection of competent organization to do the work; provision for inspections to see that specifications have been carried out. A properly made welded joint is as strong as the pipe. The simple butt-welded joint is the most efficient and is recommended for use in welding pipe. High strength and nearly equally satisfactory results are obtained with the normal socket and socket with groove joints. Due regard must be given to penetration and to the shape of the joint, particularly the reinforcement of the weld. There is no detrimental heat effect or structural weakening caused by welding.—*Iron Age,* February 21, 1929.

Contact Effects Between Electrodes and Dielectrics.—B. G. CHURCHER, C. DANNATT AND J. W. DALGLEISH.—A detailed account of the series of experimental investigations and description of the development of methods for the determination of the actual resistance and capacitance of the interface between electrodes and dielectrics. The report deals with two methods which demonstrate the existence of a potential drop across the contact face, but which do not lend themselves to accurate quantitative work. A third method is described in which the potential distribution along a cylindrical specimen, subjected to a known d.c. voltage, is ascertained by means of exploring electrodes, and the contact voltage drops deduced. Since the contact voltage drop with direct current is not affected by direct-contact capacitance effect, a fourth method was developed in which the current and watt loss were measured for a given a.c. stress of known frequency.—*Journal of the Institution of Electrical Engineers (England),* February, 1929.

Traction

3,000-Volt Automatic Substation Equipment for the South African Railways.—An interesting feature of the equipment for the main line between Glencoe and Pietermaritzburg is the use of automatic apparatus for controlling the 3,000-volt motor-generators which are used in substations. This apparatus, as well as the rest of the substation equipment, is British manufacture. This substation is used on an electrified section of the railroad which is 175 miles long and traverses mountainous country with sharp curves and steep grades. The carrying capacity of the line has been raised from 20,000 tons to 30,000 tons per diem and it is hoped that it will be increased to 35,000 tons by 1930. Trains weighing 1,600 tons can be hauled without the train being divided, as was formerly necessary, and the average time consumed on what was an eight-hour run has been reduced by half an hour. The electric locomotives can also be kept in service for a longer period than those worked by steam without repairs being necessary.—*Engineering (England),* February 15, 1929.

Railway Electrification.—G. B. SAMS.—It has been reported that the length of railway extending from London Road to Cheshire is to be converted to electric traction on 1,500 volts direct current with overhead transmission. This is an out-of-standard installation and will not be of the same voltage as the other electrified railways in the vicinity. Out-of-standard railways cannot finally exist and have to be converted sooner of later at great expense, and the time would appear ripe for evolving a definite electrification standard to be applied to all railways. Financial reasons will compel this standard to be in consonance with the existing electrified portions.—*Electrician (England),* February 15, 1929.

Telegraphy, Telephony, Radio and Signals

The Attenuation of Wireless Waves Over Towns.—R. H. BARFIELD and G. H. MUNROE.—A description of an experimental and theoretical investigation of the absorption of wireless waves produced by their passage over a town. In the course of the work the polar curve of signal intensity of *2LO* was obtained and this curve was utilized to provide a revised signal-strength contour map of *2LO*. Important differences between town attenuation and country attenuation are disclosed by the experiments. In particular, the absorption over the dense part of the town is found to increase extremely rapidly with the frequency of the waves. Aerials tuned for the reception of broadcasting in suburban districts are found to produce a critical effect on the attenuation in the neighborhood of the common wave length to which they are all tuned. Confirmatory experiments on short waves are described in an appendix, which also emphasizes the difficulty of calculating the resultant field strength in a region influenced by reradiation from one or more receiving aerials.—*Journal of the Institution of Electrical Engineers (England),* February, 1929.

Miscellaneous

The Lubrication of Ball Bearings.—Lubrication plays a very essential part in a ball bearing. In spite of the fact that the principle of the ball bearing is a rolling one in the most perfect of bearings a sliding action exists. This means friction and the friction must be overcome by the use of oil. There is need for lubrication both between the ball and the path in which it rolls and between the ball and the separator. The presence of a lubricant at these points renders almost negligible what amount of friction there is. It may seem improbable, yet there is an actual film of lubricant between the surfaces of contact, provided the lubricant is of proper quality.—*Oil-Power,* February, 1929.

The Central-Station Business Forges Ahead.—CARL W. MAEDJE.—A nationwide survey conducted by the N.E.L.A. and the Society for Electrical Development shows that the American home is only half lighted. The survey shows that less than one-third of our established businesses use electrical advertising and that the present number of lighting displays can, through organized efforts, be doubled. One company has a highly developed lighting sales department, by means of which a large return has been made possible to the company at corresponding large increases in lighting loads each year.—*Light,* February 19, 1929.

News of the Industry

New York Company Construction Budget $68,700,000

Matthew S. Sloan, president of the New York Edison Company and the electric companies associated with it, has just announced the adoption of a construction budget for 1929 amounting to $68,700,000. Of this sum $54,200,000 will be for new projects and $14,500,000 for completion of construction already authorized and in progress.

More than $20,000,000 of the budget will be spent for new construction at the present generating stations, new power-plant equipment and increasing the capacity of present equipment. Completion of an extension to the East River station of the New York Edison Company and its equipment will require $6,000,000, and increasing the capacity of the boilers in the station will take $750,000. At the Hell Gate station of the United Electric Light & Power Company $5,000,000 is budgeted for two new boilers and for remodeling existing boilers. Approximately $5,000,000 is appropriated for building new substations and enlarging existing substations.

Well over half of the budget, $40,500,000, will be spent in extending and improving the companies' transmission and distribution lines. About $17,500,000 of this sum will go for building underground conduits and installing cables in Manhattan, Brooklyn, Queens and Yonkers. A new 132-kv. transmission line from Hell Gate station to Dunwoodie substation in Westchester County will cost, it is estimated, $1,185,000.

Atterbury on Buying Power for Railroad Electrification

One of the strongest indorsations of purchasing energy for railroad electrification thus far made by a transportation executive came from General W. W. Atterbury, president Pennsylvania Railroad, when he spoke last week before the Boston Chamber of Commerce. General Atterbury said in reply to an inquiry and after dwelling upon the magnitude of the task the railroads have before them in changing their motive power in certain densely populated or rapidly growing districts:

"We worked out a jointly owned power-plant scheme with the United Gas Improvement Company and the Philadelphia Electric Company but decided not to go into it. Why should we enter the power business? We have no warrant to go into that business which is an industry by itself. By the time we are ready to use it we shall be buying power cheaper than we can make it ourselves and thereby saving a capital investment of from $20,000,000 to $30,000,000 over a great number of years."

Electrification, General Atterbury said, "will result first of all in the ability to handle much greater traffic in a shorter period of time. By the method of operation proposed we expect eventually to reduce the number of freight trains 50 per cent for a given car movement and increase the speed. This in itself provides 100 per cent increase in capacity in so far as freight movement is concerned. For passenger trains we expect to eliminate all double-heading and most of the second sections and also to avoid the possibility of rough handling due to limited starting capacity."

"Because of the greater volume of traffic and the greater economy of electrification as compared with steam operation in dense traffic," he added, "this electrification ultimately will pay for the very high cost of its installation."

Lehigh Valley Railroad May Electrify 75-Mile Stretch

Surveys for the electrification of 75 miles of double-track main line on the Lehigh Valley Railroad between Mauch Chunk and Wilkes-Barre, Pa., are being made. The reputed cost of the undertaking would be about $7,000,000. The line runs through mountainous territory in this section, and at present three-cylinder locomotives are used to move trains over the grades. The trackage for which electrification is contemplated comprises an entire locomotive division—that is, locomotives are changed at its boundaries.

Representatives of the Westinghouse Electric & Manufacturing Company, the General Electric Company and the American Brown Boveri Company are understood to be making estimates.

N. E. L. A. Exhibition to Open May 31

Convention Will Be the First Held in Mammoth New Auditorium at Atlantic City—"Golden Jubilee of Electric Light" Will Be Celebrated at Same Time

DETERMINATION to make the fifty-second convention of the National Electric Light Association at Atlantic City in the first week of June the greatest in the history of that association and to lend all possible aid to the "golden jubilee of electric light" which is to be held simultaneously, in celebration of the fiftieth anniversary of Edison's incandescent lamp, is manifest at N.E.L.A. headquarters.

A report just rendered by the association's exhibition committee, of which E. W. Goldschmidt of the Wagner Electric Corporation is chairman and Frank H. Gale of the General Electric Company secretary-treasurer, says that the opening date of the manufacturers' exhibition will be moved forward to Friday, May 31, at 6 p.m., when visitors will be admitted to the balconies. On Saturday and Sunday afternoons exhibits will be ready on the ground floor for the inspection of all. Beginning Monday, the exhibition will be open to delegates only.

This exhibition will be staged in the main theater of the new Atlantic City Convention Hall, where the N.E.L.A. assemblage will be the first to meet. This hall has cost $15,000,000. The theater is 350 ft. by 650 ft. and contains 168,000 sq.ft. of exhibition space. It would be possible to seat 60,000 or more people there were this desired, 41,000 being its normal capacity. Its dedication and opening ceremonies, which were scheduled for an earlier date, have been postponed to May 31, out of compliment to the N.E.L.A. An inaugural ball is to be held on Saturday night, June 1.

Behind the "golden jubilee of electric light" are the N.E.L.A. itself, the Association of Edison Illuminating Companies, the Illuminating Engineering Society, the Edison Pioneers and the electrical interests throughout the country. This celebration will be nation-wide, but the officials of Atlantic City, where the displays will begin, are eager to give an especially brilliant aspect to it in connection with the inauguration of the new hall and a coincident observance of the seventy-fifth anniversary of the city's incorporation. Elaborate electrical decorations of the Boardwalk, the hotels and other buildings, the city's streets and the highways entering the resort are being planned. These will be maintained from the end of May until October 21.

Three well-known electrical engineers who have been in consultation with Atlantic City officials on this celebration are S. G. Hibben, chief engineer of the Westinghouse Lamp Works; A. L. Powell, chief engineer of the Edison Lamp Works, and A. F. Dickerson, assistant to W. D'Arcy Ryan of the General Electric Company, noted lighting expert. "It is not a movement of any particular group in the industry," said Mr. Hibben, "but of the whole industry. I cannot emphasize the magnitude of the event too strongly. The necessary funds—a very large sum—are guaranteed. We propose to spend, for

example, more than a million dollars for newspaper and magazine advertising dealing with the celebration. All over the United States, during the late summer and early fall, we will establish a literal blaze of golden light by elaborate decorations, and, through this and the advertising and publicity, center the nation's attention on light and its possibilities. This program will begin with the electrical decoration of Atlantic City, the display of the resort being, in fact, the opening gun of the festival."

Features of the national celebration announced by Mr. Hibben include possible striking of a special coin and stamp by the federal government and a concluding banquet in New York City during October, when Mr. Edison will be the guest of honor. It is hoped to have Mr. Edison and Henry Ford present in Atlantic City at some point in the celebration. Radio messages from President Hoover and from foreign rulers are among the plans. These, however, are only in the earlier stages. Details will be arranged during April and the first part of May.

In the States' Legislative Mills

Home-Rule Bill to Be Reached in Illinois Next Week—Remaking Kansas Commission—Minnesota Considers Hydro Regulation—Taxing North Carolina Utilities

REGULATION and taxation of public utilities continue to be agitated in the state legislatures as adjournment draws nearer. Home rule has been promised a hearing at Springfield, Ill., next week. Minnesota may yet resolve on state regulation for her hydro companies. The Governor's St. Lawrence bill seems doomed to fail in New York. North Carolina is likely to increase the tax on the gross receipts of her power companies. Echoes of the Boulder Dam controversy are still heard. The Montana, North Dakota, Utah and Washington Legislatures have adjourned.

ARIZONA.—Asking for an appropriation of $50,000 to be used by the Colorado River Commission of Arizona and the Attorney General of that state in a fight "to preserve the state's rights," the commission has none the less expressed to the Legislature its belief that an amicable agreement is possible and that the Santa Fe compact could be accepted by Arizona if certain supplemental proposals were incorporated. The Legislature voted its confidence in the commission and the work it did at Santa Fe.

ILLINOIS.—The Illinois Municipal League's home-rule bill will be reached March 26 in the public utilities committee of the House of Representatives. The bill is the pet measure of the organization and has been before the General Assembly in all its recent sessions. At the same hearing the league's bill to require the Illinois Commerce Commission to publish a comparative statement of public utility rates will be considered. This measure would make it possible for every municipality to obtain a full statement of rates paid in all other communities of its size.

Ten southwestern Illinois cities have joined a movement for the repeal of the act under which jurisdiction of public utilities was placed with the Illinois Commerce Commission instead of the municipalities. Proponents of this plan contend it will lower electric rates in the towns. The communities are Belleville, Collinsville, Edwardsville, Highland, Mascoutah, Breese, Columbia, Millstadt, New Athens and East St. Louis.

IOWA.—Municipal and private utility interests of Iowa appeared before the joint House and Senate public utilities committees at the hearing upon a measure permitting municipalities to fix maximum rates for electric, heat, gas and water rates. Municipal plant representatives charged that the bill, through its failure to specify minimum rates, was intended to "allow independent plants to put the municipally owned plants out of business." The private utilities group denies sinister motives.

KANSAS.—The Senate placed its stamp of approval on the plan to split up the three-sided state Public Service Commission when it passed and sent to the House two bills re-establishing the Department of Labor and the Public Service Commission as they existed prior to 1925. The bill to recreate the State Tax Commission has become a law.

The Legislature enacted a bill removing the municipal light and water plants in Kansas City from political management and creating a board of five to direct the utilities. The office of water and light commissioner is abolished, leaving the city board with only four members.

MAINE.—Senator Carlton's bill to permit the exportation of power—referred to last week—provides that transmission companies may be organized for the purchase, transmission and sale of surplus electric power. They are forbidden to own and operate generating plants and may purchase power only from such generating companies as hold permits to sell their surplus, issued by the Department of Public Utilities after hearing and proof that the applicant for the permit has, or will have, a surplus of power over the amount required to meet the needs in Maine.

MINNESOTA.—Representative Milton Lightner of St. Paul has sponsored a measure for the state regulation of water power. Mr. Lightner and his supporters declare that there is enough water power in the state to make regulation desirable, pointing out that there are a number of applications for Minnesota permits before the Federal Power Commission. The bill provides for vesting regulatory power in the present Railroad and Warehouse Commission, but Mr. Lightner has offered to omit that feature. Through an attorney the Minnesota Power & Light Company of Duluth opposed the bill at a committee hearing, saying that it would retard rather than promote hydro-electric development and that the requirements of the Federal Power Commission protect the state.

A proposal for an interim committee to investigate conditions in northern Minnesota with a view to establishing a comprehensive state policy for water-power development, protection of natural resources and related questions has been approved by the Senate committee on public domain.

MONTANA.—At the closing session of the Montana Assembly last week several bills designed to impose special taxes on hydro-electric activities were killed.

NEBRASKA.—Tremendous pressure is being brought to bear on the Legislature to adopt the legislative program of the Nebraska League of Municipalities, the mayors and officers of cities and towns with municipal plants recently being brought to Lincoln and then marched to the Capitol when the House and Senate were in session. Representatives of the section the abandoned Tri-County project would have served told the legislators power was needed to operate well pumps for irrigation purposes.

NEW YORK.—Republican leaders having failed to provide an introducer for Governor Roosevelt's bill creating the "trustees of the water-power resources on the St. Lawrence River," the bills were introduced in the Senate and Assembly by Minority Leaders Downing and Bloch. It is the general consensus of opinion that the customary motion to discharge committee will be made by the Democratic leaders, which will be voted down, and that the bills will not be allowed to come out of committee this year.

The Senate has passed and sent to the Assembly the Thayer bill amending the Public Service Commission law by increasing from five to seven years after January 1, 1926, the period within which the provision requiring electrification of roads in New York City or an adjoining city may be complied with.

NORTH CAROLINA.—A lively debate took place in the House last week over the amount of the tax to be placed on the gross earnings of power companies. It is now 1 per cent and some legislators wanted it raised to 3½ per cent, the amount levied on telephone companies. Finally, the House adopted an amendment fixing it at 2½ per cent.

NORTH DAKOTA.—Bills passed by the Legislature but at the time of writing not signed by Governor Shafer include one permitting trust companies to invest in bonds of public utilities or foreign corporations whose gross earnings average more than a million dol-

lars. The Governor has signed a bill giving municipalities the right to buy, lease or operate electrical and telephone properties, the cost to be paid for from the profits of operation. A bill to provide a method for taxing public utilities, including power companies, was killed during the last minutes of the session.

UTAH.—Following its ratification of the Colorado River agreement, the Utah Legislature passed a resolution requesting that the Interior Department undertake a survey and classification of lands in the Upper Colorado Basin to ascertain their agricucltural and power potentialities. A Colorado River Commission was authorized by the Legislature, which has adjourned.

WASHINGTON.—After municipal authorities of Seattle and Tacoma had joined forces with private power interests to combat the Shipley bill for an excise tax on electrical energy, the bill was reported back to the House, with seven members of the committee opposing it and three favoring it. Representatives of the Washington Water Power Company of Spokane declared the bill would increase their taxes 63 per cent and would mean a shifting of $550,000 annually upon the small users of electrical energy. J. D. Ross, superintendent of lighting, Seattle municipal plant, declared it would tax Seattle users of light and power $650,000 a year.

The initiated bill permitting the formation of districts to deal in electrical energy will be submitted to the voters in 1930.

WISCONSIN.—Senator Polakowski of Milwaukee has a bill to abolish the Railroad Commission. Senator Severson has one which among other things requires an up-to-date report on any side-line employment given to employees of the commission by public utility companies.

McGraw-Hill Editors Complete Tour of South

Fifteen editors of McGraw-Hill magazines, including the ELECTRICAL WORLD, returned early this week from a tour of sixteen cities in seven Southeastern states, which they visited to obtain a mass impression of existing and possible industrial development. The main itinerary included Charleston, W. Va.; Richmond, Petersburg and Hopewell, Va.; Greensboro, Winston-Salem, High Point and Charlotte, N. C.; Spartanburg and Greenville, S. C.; Savannah and Atlanta, Ga.; Birmingham, Ala., and Chattanooga, Johnson City and Kingsport, Tenn., and side trips were made by some of the editors to such cities as Gastonia, N. C.; Brunswick, Ga.; Bessemer, Ala., and Bristol, Tenn. Eighty industrial plants were visited and opportunities were afforded to observe natural resources, power supply, labor conditions and other things.

In each city visited the editorial party was greeted by representatives of the Chamber of Commerce and industrial leaders and most hospitably entertained. Facilities were provided for observing an industrial and sociological cross-section of each community in the shortest possible time. The utility companies played no small part in the receptions. The party was headed by Dr. H. C. Parmelee, editorial director of McGraw-Hill magazines.

Merchandise Sales Conference of Great Lakes Section

Under the leadership of W. H. Sammis, the Commercial Section of the Great Lakes Division, N.E.L.A., held a two days' merchandise sales conference this week at the Edgewater Beach Hotel, Chicago, the first meeting of the kind to be conducted by a geographic section.

W. K. Braash, president of the Salesmanship Foundation, discussed the technique of selling domestic electric appliances, resolving the process into nine steps; Mack E. Gillis of the Commercial Investment Trust Company presented the fundamental economics of deferred-payment selling; W. L. Stensgaard of Montgomery, Ward & Company urged a greater degree of guidance from previous sales experience; J. A. Christensen of the W. T. Grant & Company chain stores contributed practical advice on the mechanics of store arrangement and stock control, and Earl Whitehorne of the ELECTRICAL WORLD pictured the problem of ten years from now and urged greater attention to the upbuilding of a prosperous and proficient independent trade.

A paper by W. H. Hodge of the Byllesby Engineering & Management Corporation and a symposium on electric water heating, to which J. C. Langdell of the Allied Power & Light Company, H. W. McCormick of the Edison Electric Appliance Company and A. J. Cole of the McGraw Electric Company contributed, followed. C. E. Greenwood of the N.E.L.A. discussed the responsibility of the power company to its trade allies, and Frank H. Lyons of the Wisconsin Valley Electric Company spoke on co-operative selling by employees. Addresses on electric cooking by F. E. Gault of the Central Illinois Public Service Company, on servicing appliances by Edward Lewis of the Rockford Electric Company, on selling refrigeration to rural customers by C. V. Sorenson of the Central Indiana Power Company, and on "What's on the Hill?" by C. S. Holland of the Commonwealth Edison Company completed the program. The merchandising sales conference was followed by meetings of the committees of the N.E.L.A. Commercial National Section.

On March 22 and 23 a conference on electric service for the farm, sponsored by the Great Lake Division's rural electric service committee, was to be held at the Palmer House with addresses by Charles F. Stuart, G. C. Neff, J. Paul Clayton, E. N. Strait and John G. Learned, followed by fifteen talks or papers on developing appreciation of farm service and selling equipment to the farmer.

Oklahoma Utilities Association Elects Officers

Interest in the general and divisional sessions of the convention of the Oklahoma Utilities Association held at Oklahoma City last week and reported on page 552 of the ELECTRICAL WORLD for March 16 was maintained to the close. The total registration was well over a thousand.

During a safety conference resolutions were adopted asking the executive board of the association to create an Accident Prevention Section. The new section will work actively to interchange ideas and experiences among members on accident prevention work, to stimulate interest in accident prevention and health work in companies which do not at present have such programs and to assist in educating the public on these matters.

On the final day of the meeting these officers were elected: President, Thomas R. Weymouth, Tulsa, president Oklahoma Natural Gas Corporation; first vice-president, T. H. Steffens, Sand Springs, president Sand Springs Railway Company; second vice-president, S. I. McElhoes, Oklahoma City, vice-president Southwestern Light & Power Company; treasurer (re-elected), W. R. Emerson, Oklahoma City; manager (re-elected), Edward F. McKay, Oklahoma City. R. K. Lane, Tulsa, vice-president Public Service Company of Oklahoma, was made chairman of the Electric Division and S. I. McElhoes the board member for that division.

Hartley Tells of California Bureau Activities

Documents relating to the water and power bill, a referendum measure which was thrice decisively defeated by the voters in California—1922, 1924 and 1926—weer introduced before the Federal Trade Commission on March 20. Testimony taken by a committee of the California Senate showing that public utility corporations actively combated the bill was included. The commission called no witnesses on Wednesday, adjourning until Friday morning.

Recalled to the stand on March 14 to continue his testimony in the commission's investigation of the utilities, Victor M. Hartley, executive secretary of the California Electrical Bureau, described the steps which were taken against the water and power bill when it was before the California State Legislature. The bureau lent the services of R. L. Eltringham, then secretary, continuing his salary throughout his legislative activity. Mr. Eltringham did not report to the bureau concerning this work nor were his expenses reimbursed from bureau funds. Such arrangements as he made were handled directly with the power companies or other co-operating parties, it was stated.

Purchases and Mergers

Southeastern Companies Sell Gas Plants to Devote Themselves to Electric Service — Small Transactions Continue in Every Section of the Country

SALE to the Central Public Service Corporation of Chicago of gas plants at Selma, Montgomery, Tuscaloosa, Anniston and Decatur, Ala., by the Alabama Power Company; at Atlanta, Macon, Athens, Brunswick and Decatur, Ga., by the Georgia Power Company, and at Columbus, Meridian and Hattiesburg, Miss., by the Mississippi Power Company, is announced. The sales are indicative of the plan of Southeastern Power & Light companies to devote their entire effort to the electrical field.

Organization under the laws of Delaware of the Southwest Utilities Corporation, a wholly owned subsidiary of the Empire Public Service Corporation, which will include the Big Spring Public Service Company, Consumers Natural Gas & Power Company, Texas Electric Company and other utilities, is announced. This new corporation furnishes, through its subsidiaries, electric light and power and other utility services to ten small municipalities in Texas and Louisiana.

A power plant owned and operated by Leander O'Neill at Amelia, Va., has been sold to the Superior Electric Power Company of Ohio.

The Keystone Public Service Company, with power and light holdings in Oil City, Franklin and Titusville, Pa., has applied to the Public Service Commission at Harrisburg for permission to buy the Utica Light & Power Company and Polk Light & Power Company holdings in Venango County.

Announcement has been made by M. J. Kehoe, president of the London (Ohio) Light & Power Company, of the sale of the company's property to the Ohio Edison Company, Springfield. The London company had purchased Ohio Edison energy and transmitted it over its own line from Springfield to London.

The North Baltimore (Ohio) Water & Electric Company has been sold to the Associated Gas & Electric Company, New York, by G. A. Harrup. Harrup has sold his electric plants at Flora and Loogootee, Ind., to the same company, and his fourth plant at Rising Sun, Ind., to that city.

The Wisconsin Gas & Electric Company, Racine, has exercised an option upon the Hartford-Rubicon Electric Company at Hartford, Wis., and now owns it.

Bayport (Minn.) citizens at an election on March 12 rejected an offer of the Northern States Power Company to buy the village electric distribution plant for $60,000. Although 308 voted for the sale and 219 against, a two-thirds majority was necessary. On the same day Moose Lake (Minn.) voters approved a proposed municipal light and power project, 115 to 82.

The Federal Public Service Company, the new owner of the Root River Power & Light Company, Preston, Minn., has also purchased the Rushford (Minn.) Power Company. The electric distributing system at Norcross, Minn., has been purchased by the Otter Tail Power Company.

Bruno Just has obtained permission to sell the electric property at Judson, N. D., to the North Dakota Power & Light Company.

The Northern Power & Light Company has purchased the municipal plant at Selfridge, N. D.

The Oil Fields Power Company, Cody, Wyo., which buys energy from the Shoshone Dam of the United States Reclamation Service for use in the North Cody and Oregon Basin oil fields, has been taken over by the Mountain States Power Company, Casper, Wyo., subsidiary of the Standard Gas & Electric Company, Chicago.

An offer of $40,000 cash for the municipal plant at Glenrock, Wyo., has been made by the Mountain States Power Company, which for some time has been supplying the town with electricity, the plant being shut down. The offer, which includes one of lower rates, will go to the voters.

Illinois Governor Stands by Utility Regulation

He Speaks Encouragingly Before Joint Meeting of the Three State Associations—Program of Electric Association Covers Ample Field

FOR the fourth consecutive year the Illinois State Electric, the Illinois Electric Railways and the Illinois Gas associations held their annual conventions this month in Springfield, meeting on March 14 and 15 with approximately nine hundred delegates in attendance, of whom Chicago furnished more than three hundred. Eight addresses were given before joint morning meetings, and six papers were read before the Illinois State Electric Association at the separate afternoon sessions of that division. The women's committee had, besides, a session of its own.

Governor Louis L. Emmerson, who addressed a joint meeting Friday morning, reaffirmed his faith in the state's system of utility regulation, saying:

"I believe the powers vested in the Illinois Commerce Commission under present laws are sufficient to insure intelligent regulation. It will be the policy of my administration to insist that these laws are administered by the commission in a manner which will result in the greatest benefit to the public and the fairest and most intelligent treatment of the utilities. I regard this commission as a court which should be composed of men of the highest integrity, and, being so constituted, it should function without executive suggestion or interference.

"Public ownership," the Governor went on, "is coming rapidly, but it is coming in the form of customer ownership and employee ownership. As the average man becomes more familiar with the investments in securities in corporations and as the utilities see more clearly the value of customer ownership, I am convinced the day approaches when most of your stockholders will be the people who use your service."

A second speaker on the Friday morning program, James D. Cunningham, president of the Illinois Manufacturers' Association and head of the Republic Flow Meters Company, Chicago, saw the solution of the farm problem in the increasing number of factories in small towns. The expense of maintaining plants in congested metropolitan districts is driving manufacturers to seek sites in smaller communities, and the availability of power in these communities will bring many industries from the city to the small town, he said.

The importance to the utility company of accurate statistics and all-inclusive data was stressed by Alexander Forward, secretary-treasurer of the American Gas Association. Exact figures on housing conditions in Chicago were given by E. V. Stevens, assistant statistician of the Commonwealth Edison Company, in an address on "Effective Use of Statistics" which was given before the electric group Friday. Vigorous sales campaigns were advocated by F. P. Cope, Allied Power & Light Corporation, Jackson, Mich., and by W. S. Vivian, Middle West Utilities Company, Chicago.

Mercury-arc rectifiers in use by the Chicago & Joliet Electric Railways Company have proved satisfactory, A. W. Baumgarten, division engineer of the road, reported. A rectifier at Lemont substation effected an estimated annual saving of $9,576, he said. A complete set of construction standards for rural electric lines was presented by J. D. Roberts, chief engineer Central Illinois Public Service Company, Springfield.

Others on the program were Tom C. Polk, secretary Great Lakes Division, N.E.L.A.; J. F. Blackburn, Rockford Gas & Electric Company; S. E. Doane, General Electric Company; S. L. Hilyard, Illinois Power & Light Corporation; J. R. Pershall, Public Service Company of Northern Illinois; H. A. Kleinman, Moline; A. G. Ford, Aurora; Donald M. Mackie, Jackson, Mich., and Miss Isabell Davie, N.E.L.A. headquarters.

Officers of the Illinois State Electric Association chosen for 1930 were: President, E. F. Kelly, Central Illinois Public Service Company, Springfield; vice-president, Oliver Hoque, Commonwealth Edison Company. G. W. Schwaner, Springfield, was re-elected secretary-treasurer of the three bodies.

Rapid Recuperation from the South Alabama Floods

A report received from the Alabama Power Company regarding the effect upon its service of the recent floods on southern Alabama and Georgia and north Florida rivers says that no major troubles were met with. Interruption of service was confined to three communities which were entirely inundated. These were Brewton, Flomaton and Geneva. Service was restored in all three as the waters subsided, and on Tuesday the situation was entirely satisfactory.

Elba, the town where flood conditions were reported to be worst, is served by the Pea River Power Company, which has its main office at River Falls, Ala. This company generates its energy from small hydro and steam plants.

More Rate Reductions

Providence, R. I.; Haverhill and Chicopee, Mass.; Omaha, Neb.; Upstate New York Cities, Illinois and Maryland Will Benefit from Cuts

A REDUCTION in the lighting rates of the Narragansett Electric Company of Providence, R. I., which, the company states, will save its customers more than $70,000 during the coming year, is embodied in new rates filed with the Public Utilities Commission by General Manager S. B. Swan. The new rates will, if approved, become effective on all electricity billed on and after April 1. Decrease in the combined residence lighting and appliance rate is made by reducing the amount of electricity billed at the top rate of 5 cents per kilowatt-hour from 75 kw.-hr. per month to 60 kw.-hr. and by reducing the rate from 3 cents to 2 cents for all electricity in excess of 200 kw.-hr. Commercial and installation rates are also reduced.

The Holyoke (Mass.) gas and electric department has reduced rates on electricity to all consumers, effective May 1. Rates for lighting are reduced to 5 cents per kilowatt-hour for the first 100 kw.-hr. per month and 4½ cents for all over 100 kw.-hr., with discount of 1 cent per kilowatt-hour on bills paid within ten days. Power rates are reduced to 3.75 cents for the first 200 kw.-hr. per month, 3.15 cents for the next 200, and so on.

The Chicopee (Mass.) electric light department's new building, used for offices and sales, was formerly opened with a dinner attended by 200 prominent citizens on March 6. Roy P. Benedict, manager of the department, announced rate reductions averaging 7.7 per cent and effective April 1. Beginning at 5 cents a kilowatt-hour for the first 25 kw.-hr., the rate is stepped down till it reaches 1.7 cents for any excess over 102,000 kw.-hr. a month.

The Nebraska Power Company has reduced residential rates in Omaha in an amount totaling $200,000 a year. The new rates are 5½ cents for a block of kilowatt-hours equal to 10 kw. per room per month; for the next 160 kw.-hr. 3 cents, and for all above that 1½ cents. The last rate is included in an effort to induce use of electricity for heating houses and for cooking purposes. Immediately upon acceptance by the Omaha Council, the Citizens' Gas & Electric Company of Council Bluffs, Iowa, a subsidiary, will announce similar reductions in that city.

New residential rate schedules of the New York Power & Light Corporation for Cohoes, Troy and Watervliet, N. Y., similar to the new Albany rates noted on March 2 (page 461), have been approved by the New York Public Service Commission, which has also approved a new schedule of the New York Central Electric Corporation lowering rates in Corning, Hornell and other places.

Agreement on a substantial cut in rates for residence service in Syracuse was reached by the city administration and the Syracuse Lighting Company on March 16. The new rate, if sanctioned by the commission, will be made up of a charge of 30 cents "per counted room" a month (three-room minimum) plus 3 cents a kilowatt-hour. On the basis of consumption last year it is estimated that the new rate will result in a saving of $240,000 to Syracuse district residents. The present rate is 7½ cents per kilowatt hour for the first 25 kw.-hr. and 5½ cents for the next 275.

The Illinois Power & Light Corporation has filed with the Illinois Commerce Commission a new schedule of retail power rates, effective April 1, which will effect savings of from 10 to 20 per cent. The new schedule is 6 cents per kilowatt-hour for the first 400 kw.-hr., 3½ cents for the next 600, 2¾ cents for the next 1,000 and 2 cents for all in excess of 2,000 kw.-hr.

According to new rate schedules filed with the Public Service Commission of Maryland by the Suburban Electric Power Company, lighting service in the southern part of the state is now available at rates varying from 10 cents to 4 cents per kilowatt-hour. This rate applies to rural sections and small towns. In more thickly populated areas the rate will be from 7 cents to 3 cents.

View Technical Progress

N.E.L.A. Engineering National Section at Memphis Records Advances and Canvasses Problems That Confront the Industry in System Operation

MANY aspects of the intricate questions that constantly press for solution in the laboratories where power houses and transmission systems are designed and technical research is prosecuted were viewed at Memphis last week, where, as briefly reported in the ELECTRICAL WORLD for March 16, the Engineering National Section of the N.E.L.A. held a four-day session for committee meetings and consultation.

Recent progress in the investigation of lighting was related to the overhead systems committee by F. W. Peek, who spoke also to the electrical apparatus committee on non-resonant transformers and the behavior of surge voltages in transformers and other electromagnetic apparatus. Artificial lightning potentials up to 5,000,000 volts are now available and have been used in tests on transmission lines. Much progress has been made in the measurement of lightning wave shapes, and cathode-ray oscillograms of actual lightning discharges have been secured. Mr. Peek remarked in regard to the energy content of lightning that although the potential and current values might be of the orders of 100,000,000 volts and 100,000 amp., the energy would be only about 4 kw.-hr. on account of the very short duration of the flash.

Other matters that engaged the attention of the overhead systems committee were transmission-line construction as dealt with in two excellent illustrated talks, service restoration in a series of papers describing practices of utilities in various parts of the country, wood preservation, transformer specifications and maintenance procedure on distribution systems.

A report on the present status of the fractional-horsepower motor situation was given to the electrical apparatus committee and drew forth considerable discussion. A proposal for the elimination of 110 volts as a standard service voltage found the committee evenly divided, and it was held for a succeeding meeting. The operating aspects of interconnections and operating points to be covered in interchange energy agreements received attention, as did also the virtues of metal-clad and other forms of non-oil-throwing switchgear. The effects of motor-starting currents on systems received consideration, and means for their control were discussed.

The underground systems committee devoted time to the testing and inspection of cable as received and installed and set up a definite classification of various types and kinds of tests so that data derived therefrom in different situations might have easily comparable values. Analysis of cable failures, status of research on impregnated paper-insulated cables, conduit and manhole construction and cable operation were all treated by the committee. The sessions concluded with a round-table discussion on operation and construction.

Higher steam pressures, pulverized fuel, design of stokers and furnaces, condensing equipment and a general discussion on power-station betterment occupied the prime movers committee. Some time was given also to consideration of steam generating apparatus modeled after that designed for use in steam automobiles.

Outdoor metering received special attention from the meter committee in consideration of the present interest in that subject and of recent development in that line. It was the feeling of the committee that outdoor meter installations have a definite place in meter practice and that that place has been known and recognized for many years. For difficult locations of many kinds the outside meter is desirable and in some cases necessary, and the present developments along that line have their accepted field of use. The committee also considered high-tension metering, two-rate meters, test record systems, voltage ratings, educational work and meter department organization.

The accident prevention committee laid out for itself a full schedule which covered papers and discussions on automobile accidents, the costs of accidents, awards of the Insull medal and the temporary grounding of electrical lines and circuits while work is being done.

The characteristic wave shapes of generators and the effects of these configurations in disturbances on signal and communication systems were discussed by the inductive co-ordination committee. Radio interference received its meed of attention. Grounding practices and the development of codes and standards also were treated.

Briefer News

CENTRALIA, WASH., VOTES TO BUILD MUNICIPAL PLANT.—By a large majority the voters of Centralia, Wash., have indorsed a bond issue for $950,000 to build a municipal power plant on the Nisqually River. It is to have a rating of 11,000 hp., which may be raised to 30,000 hp.

BISMARCK (N. D.) COMPANY HAS CHANGED NAME.—The Hughes Electric Company of Bismarck, N. D., which serves more than a score of communities with the North Dakota capital as a center, has changed its name to the North Dakota Power & Light Company.

INDIANA & MICHIGAN TO ERECT SEVEN-STORY OFFICE BUILDING IN SOUTH BEND.—Plans have been approved by the Indiana & Michigan Electric Company for a seven-story office building at South Bend instead of the five-story building originally planned to replace the present structure. Construction is expected to begin immediately. The building will cost about $250,000 and will be of steel, concrete and brick.

GEORGIA POWER COMPANY'S COMMERCIAL RATES MAY BE MADE UNIFORM.—The Georgia Power Company has been summoned to defend its commercial electric light and power rates before the Georgia Public Service Commission on April 8, complaints of discrepancies having been received. It is probable that uniform commercial rates will be established by the commission all over the state, following the precedent set when it applied this principle to residential rates not long ago.

ENGINEERING SECTION, NORTHWEST N.E.L.A. WILL MEET AT WALLA WALLA, WASH.—The program for the annual meeting of the Engineering Section, Northwest Electric Light and Power Association, at Walla Walla, Wash., on Monday, Tuesday and Wednesday, next week, includes contributions from headquarters officials of the N.E.L.A. as well as from the committee chairmen and others prominent in the geographical organization. Headquarters will be at the Marcus Whitman Hotel.

OHIO UTILITIES MUST POST LARGE SUMS TO COVER POSSIBLE REBATES.—The Ohio Public Utilities Commission has been directed by Governor Cooper to cite utility corporations with rate cases pending under the Pence law, which has been repealed, to post additional bonds with the commission to guarantee refunds on increased rates collected if the proposed rates are eventually disallowed. The commission will notify each company affected and require cause to be shown why it should not be required to file additional bonds at once. The order will affect about thirty utilities which in the last few years have collected under the Pence law approximately $18,000,000 in increased rates, without waiting for the commission approval now rendered obligatory.

NEW LINE FOR THE TEXAS PANHANDLE.—An extension of its power transmission system in the Panhandle of Texas will be undertaken soon by the Panhandle Power & Light Company, according to C. R. Stahl, general manager. The new power line will be 30 miles long and will carry 66,000 volts. It will run from Lefors to Mobeetie by way of Laketon, Kelton, Zybach and Gageby. The line will be of wooden pole construction and will cost, together with a substation, approximately $150,000.

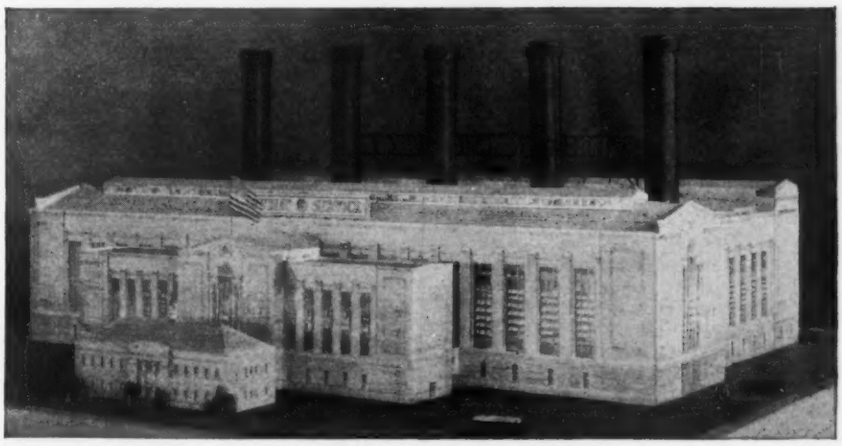
"POWER-CIRCUIT ANALYSIS" TO BE MADE AT THE M.I.T.—Announcement comes from the Massachusetts Institute of Technology that its electrical engineering department will on June 10 to 22 hold a "colloquium" on power-circuit analysis with particular reference to the behavior of machinery and to transmission-line stability. The technical sessions will be conducted by means of lectures and round-table discussions given and directed by members of the electrical engineering staff and by engineers invited from manufacturing companies, operating companies and consulting-engineering offices. Programs can be had from Prof. G. Dahl, who will direct the colloquium.

DES MOINES RIVER HYDRO PLANT.—Formation of the Des Moines Valley Electric Company, capitalized at $500,000, to erect the contemplated hydro-electric plant on the Des Moines River 4½ miles south of Kalo, Iowa, is announced by Frank Maher, a Fort Dodge attorney who heads the company. The dam will be 22 ft. high and form a lake extending nearly 12 miles to the edge of Fort Dodge. Engineers of the Byllesby Engineering & Management Corporation have furnished data based on a three months' survey of the site. The plant is one originally planned by Cedar Rapids interests, which have transferred their rights and property to the new company. The expected output is not stated.

SAFE HARBOR WATER POWER COMPANY GETS CHARTER. — Issuance in Pennsylvania last week of a charter to the Safe Harbor Water Power Company indicates that the Pennsylvania Water & Power Company is going ahead with its plans for the construction of a hydro-electric plant on the Susquehanna River, 10 miles above the present Holtwood dam of the parent company. Ultimate plans are for a development much larger than the existing 180,000-hp. Holtwood plant, and a possible expenditure of $30,000,000 is estimated. The Consolidated Gas, Electric Light & Power Company of Baltimore gets a large part of its energy from Holtwood, and the hydro plants there may figure in Pennsylvania Railroad electrification.

RAPID PROGRESS AT DEEPWATER (N. J.) PLANT.—The 118,500-kw. generating station being designed and constructed by Stevens & Wood at Deepwater Point, N. J., on the Delaware River, for operation by the Delaware River Manufacturing Company, is progressing so rapidly that indications are it will be in service before the middle of November. The first of the six drums for the 1,400-lb. pressure boilers has just been received at the site. The first of the two main units, a compound General Electric turbo-generator of 53,000 kw., will be shipped from Schenectady early in May. The station is to be operated entirely on pulverized fuel, using both the unit system and the bin system. The exhaust from a 1,200-lb. high-pressure 12,500-

Kearny (N. J.) Station as It Will Eventually Be



WHEN it reaches its final stage the great Kearny generating station of the Public Service Electric & Gas Company of New Jersey will have the exterior appearance of the model photographed above, which was very recently made. The first half of the station, with five turbo-generators and a total rating of 205,100 kva., has been in service for two and a half years.

kw. turbine will supply steam through evaporators to the nearby plant of the Du Pont company, which is also entitled to all the electric power generated by the steam going through this turbine. This power plant is being built jointly by the United Gas Improvement Company and the American Gas & Electric Company.

NEW BRUNSWICK HYDRO CONTEMPLATES AUXILIARY STEAM PLANT.—The Electric Power Commission of the Province of New Brunswick has reported to the Legislature that additional power must be supplied at the earliest possible date. In respect to sources of power the report refers to the Meductic site on the St. John River, and says that as no progress has been made with that development preliminary plans and estimates for the erection of a modern auxiliary fuel plant have been prepared.

COMING HIGH-TENSION LINES IN THE WEST.—Definite arrangement for the construction for Western subsidiaries of two 66-kv. transmission lines designed to permit their future operation at 110 kv. has been made by the Federal Light & Traction Company. One of these lines will be built in New Mexico from Bernalillo to Santa Fe, a distance of 50 miles, and the other in Washington from Gray's Harbor to Willapa Harbor, a distance of 40 miles. Both lines will be carried on steel poles.

WATER AND POWER BOARD TO BE SET UP IN BRITISH COLUMBIA.—The provincial water board of British Columbia will, under the new name of Water and Power Board, control public utility company operations in that province under plans laid before power companies by the government at a conference in Vancouver, but these are subject to amendment following protests by the companies against some details of the plan as regards compulsory service and rate regulation.

ROCHESTER COMPANY ERECTING LINES TO LINK IN MOUNT MORRIS DEVELOPMENT.—Construction of a 110-kv. steel-tower transmission line from Rochester to Mount Morris, N. Y., to link with the line now under construction from Elmira to Geneva will be begun next month, according to Charles L. Cadle, general manager of the Rochester Gas & Electric Corporation. The new line is intended to carry power to the site of the company's Mount Morris hydro-electric project, which will cost $10,000,000 when completed. A 33,000-volt line is being built from Mount Morris to Perry.

SOULANGES POWER COMPANY APPLICATION POSTPONED.—At the request of Premier Taschereau of Quebec, the sponsors of a bill to amend the charter of the Soulanges Power Company have agreed to withdraw the application till next year. Premier Taschereau explained that the application, covering another St. Lawrence development plan, was of cardinal importance, comparable to the Beauharnois scheme and involving the construction of waterways, and that the engineers of the government had not as yet had sufficient time to make their report.

COOLIDGE DAM WILL SOON HOLD BACK ENOUGH WATER TO PERMIT GENERATION OF POWER.—Progress on the Coolidge Dam in Arizona is reported by the secretary of the Arizona Utilities Association as follows: There is now 55 ft., or approximately 16,000 acre-feet, of water stored behind the Coolidge Dam. It forms a lake about 5½ miles in length lying in the beds of the Gila and San Carlos Rivers. When the waters rise to a height of 64 ft. they will flow through penstocks at the dam and the generation of electric power will begin. Sixty-four feet of water will mean that the lake will contain 25,000 acre-feet, the minimum which will thereafter be stored. No power can be generated with a less amount of water behind the structure. It is expected that this minimum will soon be reached. The storage capacity of the Coolidge reservoir is 1,285,000 acre-feet. When this capacity has been reached, the lake formed will be 22 miles long and about 5 miles wide. It will back the water up to within 4 miles of the town of Rice on the San Carlos River and to within about the same distance of Bylas station on the Gila.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

Northwest Electric Light and Power Association — Engineering Section, Walla Walla, Wash., March 25-27. Berkeley Snow, 1206 Spalding Bldg., Portland, Ore.

Iowa Power and Industrial Conference —State University, Iowa City, April 2 and 3. C. C. Williams, dean.

Arizona Utilities Association—El Conquistador Hotel, Tucson, April 4-6. Lee C. McCullough, 134 South Central Ave., Phoenix.

Maryland Utilities Association—Emerson Hotel, Baltimore, April 12. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

American Welding Society—Engineering Societies Bldg., New York, April 22-26. M. M. Kelly, 29 West 39th St., New York.

Middle West Division, N.E.L.A.—Hotel Fontenelle, Omaha, Neb., April 24-26. T. A. Browne, Lincoln, Neb.

Southwestern Division, N.E.L.A. — Arlington Hotel, Hot Springs, Ark., April 30-May 3. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Southwestern Public Service Association—Hot Springs, Ark., April 30-May 3. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Arkansas Utilities Association — Arlington Hotel, Hot Springs. Ark., April 30-May 3. R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

Indiana Electric Light Association — Hotel Gary, Gary, Ind., May 1-3. William Stokes, 1548 Consolidated Bldg., Indianapolis, Ind.

American Institute of Electrical Engineers—Regional meeting, Dallas, Tex., May 7-9. F. L. Hutchinson, 33 West 39th St., New York.

East Central Division, N.E.L.A. — Louisville, Ky., May 7-10. D. L. Gaskill, Greenville, Ohio.

Southeastern Division, N.E.L.A.—Asheville, N. C., May 8-10. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

National Electrical Manufacturers' Association — The Homestead, Hot Springs, Va., May 20-25. S. N. Clarkson, 420 Lexington Ave., New York.

American Electrochemical Society—Toronto, May 27-29. C. G. Fink, Columbia University, New York.

National Electrical Wholesalers' Association—The Homestead, Hot Springs, Va., May 27-31. E. Donald Tolles, 165 Broadway, New York.

National Electric Light Association—Atlantic City, N. J., June 3-7. A. J. Marshall, 420 Lexington Ave., New York.

ONTARIO HYDRO WINS OVER FOSHAY AGAIN.—In the power war in the Bruce County district of Ontario between the Hydro-Electric Power Commission of that province and the Foshay interests of Minneapolis a second victory for the Hydro has been won at Southampton, where on March 11 the voters by 228 to 194 decided to purchase the existing system. Last fall an enabling by-law to make this possible was passed by a larger majority. The victory seems to insure that Southampton will go on the Hydro's lines, and efforts are being put forth to have the other towns with privately owned plants follow suit.

SAN FRANCISCO LOSES $319,000 IN REVENUE BECAUSE OF WATER SHORTAGE.—San Francisco lost $319,000 in receipts from Hetch Hetchy power during December, January and February, as compared with the same months a year ago. This was the report made by the Board of Public Works when the Pacific Gas & Electric Company presented its monthly check for power received under its agency contract from the Moccasin Creek plant of the city's water project. Lack of water run-off in the High Sierra prevented the Hetch Hetchy plant from running to good capacity.

NEW TRANSMISSION LINE IN THE BERKSHIRES FORESEEN.—The Montague Company, a subsidiary of the Turners Falls Power & Electric Company, has acquired from the Berkshire Street Railway Company and in turn has deeded to the Quinnehtuk Company, a new subsidiary of the Western Massachusetts Companies, a 24-mile strip of land, extending from Huntington to Lee, Mass., representing the location of the electric road abandoned soon after it was built in 1911. The transaction also includes the sale of a right-of-way 12 miles long from Lee to Sheffield, Mass. The purchase provides a route for a high-power transmission line, but a representative of the Turners Falls company said that the use of such a line and the time when it might be built were matters for future determination.

PERSONNEL OF INTERNATIONAL WATER COMMISSION FOR COLORADO AND RIO GRANDE.—Preparations are being made by the American section of the International Water Commission for the inauguration of its work in connection with the Rio Grande and Colorado Rivers. The American section expects

to meet in Washington within a month. Dr. Elwood Mead is chairman. The other members are General Lansing H. Beach and W. E. Anderson. G. W. Hamilton is the power expert for the American section and professor Frank Adams its consulting engineer. The Mexican section of the commission lately has been reorganized with Fortunato Dozal as chairman. Gustavos P. Serrano, formerly chairman, remains as a member of the commission. The other member is Ignacio Lopez Bancalari. Ferderico Ramos is secretary of the Mexican commission.

Los Angeles Water and Power Bureaus Consolidated.—To "assure greater co-ordination and greater efficiency," the Los Angeles Water Bureau and Power Bureau have been combined under the title of Municipal Department of Water and Power of the City of Los Angeles, with H. A. Van Norman as chief engineer and general manager. This change was made effective March 15 by the Board of Water and Power Commissioners. E. F. Scattergood, former chief engineer and general manager of the Power Bureau, is to be chief electrical engineer of the unified organization. Frank E. Weymouth is to be the chief hydraulic engineer. Minor divisions of the two former bureaus, such as accounting and similar bodies, will continue as before. The various engineering staffs serving both bureaus will be consolidated into one flexible organization with general authority for all their activities vested in Mr. Van Norman.

Rapid Progress on Lake Lamoka Development.—Construction of the Lake Lamoka high-head hydro-electric power development near Penn Yan, N. Y., has progressed to a point where installation of the generating equipment in the power house on Lake Keuka will be the next step. Shipment of the turbines and generators will be made from the Pittsfield (Mass.) plant of the General Electric Company this month. The power plant has been built with two sides of reinforced concrete and the ends covered with corrugated steel so that additional expansion will be facilitated. The first stage in the project, to dam the floodwaters of the Cohocton River and the watershed of Lake Lamoka, will be completed in June or July. This work includes the construction of a two-mile canal and the installation of a 3,600-ft. penstock. The original date set for completion of the project was November, 1929, but the present outlook seems to indicate that the plant will be in part operation by July 1.

Oklahoma Gas & Electric to Build Plant at White Eagle.—A power plant with an initial rating of 15,000 kw., to be called the Lincoln Beerbower generating station, will be built at once by the Oklahoma Gas & Electric Company on the Arkansas River near White Eagle, Okla., Vice-President J. F. Owens announces. Nearly a year will be required to complete it. This station will be in the company's northern division, of which Enid is the operating headquarters, because of the increased requirements of flourmills and other industries in that territory. The site has been acquired and equipment ordered. The high-pressure steam-driven turbines will be of the most modern kind. Current will be generated at 13,800 volts and stepped up to 66,000 volts. Two high-voltage transmission lines will connect the plant with Enid and a third line will connect it with the transmission system on which are the major generating stations at Horseshoe Lake, Riverbank and Byng and the fifteen auxiliary stations throughout the state. In naming the new station the company has honored the memory of Lincoln Beerbower, a member of its organization for twenty-five years and for eighteen years manager of the northern division with headquarters at Enid. Mr. Beerbower died last November.

Commission Rulings

Territorial Invasion Permitted Where Natural Occupant Was Dilatory.—Approval of the invasion of a smaller power company's territory by the Consolidated Gas, Electric Light & Power Company of Baltimore was given by the Maryland Public Service Commission when that body signed an order for the extension of Consolidated lines into Carroll County. The territory into which the line will go had been considered within the service area of the Consolidated Public Utilities Company of Westminster, but a delegation of residents asked the regulatory body to approve the extension, saying that for several years they had been petitioning the Westminster company to give them service but that they had been continually put off. The commission stipulated that the work be completed within three months.

Commission Justifies Competition Under Certain Conditions.—Although it has always been the avowed policy of Missouri, according to the pronouncement of its commission, as quoted in the *Public Utilities Fortnightly*, to favor regulated monopoly, rather than to encourage competition, this is by no means an absolute and unvarying rule, but was primarily to protect the public from the economic burden of wasteful duplication of utility service, and where it fails to do so there is no reason why competition in the public interest should not be permitted. This question arose upon the application of the Industrial Gas Company for a certificate to operate a business in Kansas City for the benefit of industrial consumers. The local distributing company objected, claiming the protection of a guarded monopoly. The commission held that the existing company, buying, as it did, its supply from an affiliated interstate wholesale company that was beyond the regulatory jurisdiction of the commission as to supply rates, was not such a regulated monopoly as would be entitled to claim protection from the independent company, which was entirely subject to rate jurisdiction.

Recent Court Decisions

Where Boy Crawling Through Wire Fence Was Electrocuted Because Fallen Wire Was in Contact Therewith, the Thing Spoke for Itself.—A fallen transmission wire of the Carolina Power & Light Company in contact with a wire fence caused a boy crawling through the fence to look at fire at the edge of woods to be electrocuted. There was testimony that the company had been notified of the fallen wire in ample time to turn off the power before the fatality. A verdict of $23,000 to his father was sustained by the Supreme Court of North Carolina, which held that the doctrine of *res ipsa loquitur* ("the thing speaks for itself") was applicable and that the defendant, which did not plead contributory negligence, could not have the issue of contributory negligence submitted to the jury. (146 S.E. 204.)*

Utility Not Permitted to Enjoin Commission from Making New Valuation.—By decision of the Washington State Supreme Court the Gray's Harbor Railway & Light Company is denied a writ of prohibition to enjoin the Department of Public Works from making an entirely new, original valuation of its electric properties. Prior to 1915 a primary valuation had been made by the department, which was subsequently brought down to that year. Upon complaint against the company's rates in 1927 the department started an entire revaluation of the property, to which the company objected, insisting that the proper method would be to bring the previously established valuation down to date. The company claimed it would be put to great labor and expense to produce the original data and to obtain necessary witnesses. The court holds that the appellant has an adequate remedy by appeal and that prohibition brought about by court decree is not the proper procedure to be followed.

Income Tax in Wisconsin Falls on Holding Company and Its Subsidiary Both.—Both an operating company and its holding company are subject to an income tax, the Wisconsin Supreme Court held in a suit brought by the Wisconsin Public Service Corporation against the Tax Commission. The Public Service company owns all the stock of the Menominee & Marinette Light & Traction Company at Menominee, Mich., and manages the affairs of the subsidiary company. It contended that the traction company paid all of the taxes assessed against such an enterprise and that the holding company was not responsible for additional taxes. Justice Walter C. Owen in the opinion declared: "The Service company contends that it is in fact the owner of the traction company—this because it owned all of the stock and bonds of the traction company, had control of its affairs and, in fact, managed and directed the business of the traction company. The traction company, however, was a distinct corporate entity. Unless the doctrine of distinct corporate entities be ignored, it cannot be said that in law the service company owned the property of the traction company."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

Ralph Neumuller to Direct Westinghouse Institute

Ralph Neumuller, recognized as one of the leading advertising and merchandising men of the electrical central station industry, has resigned from the United Electric Light & Power Company, effective April 1, to become director of the new Westinghouse Lighting Institute located in the Grand Central Palace, New York City, which it is expected will be opened in the early summer. The Westinghouse Lighting Institute, which is sponsored by the Westinghouse Lamp Company, will carry on work dealing with every phase of electrical illumination in a practical and scientific manner.

Mr. Neumuller became identified with the central station industry in 1914 as assistant advertising manager of the New York Edison Company. Following discharge from military service in 1919 he became advertising manager of the United Electric Light & Power Company and in 1925 he became manager of both the advertising and merchandising activities of the company. Always an ardent member of the National Electric Light Association, and an eminently successful worker on many committees of that association, Mr. Neumuller was elected in 1926 to the chairmanship of the Metropolitan New York Section. He has also been closely identified with activities of the Society for Electrical Development, the Empire State Gas and Electric Association, the Utilities Advertising Association and the New York Electrical League.

CARL S. MAKEIG has been appointed general manager of the Gulf Public Service Company of Louisiana, with headquarters at New Iberia. For the past two years Mr. Makeig has been district manager of the Southwestern Public Service Company, in charge of the eastern New Mexico group, with headquarters in Roswell. Previous to that time he was for several years manager of the Amarillo (Texas) properties of the same company. In Louisiana Mr. Makeig will direct the operations of a wide variety of electric, ice and other properties extending throughout the state. The groups referred to are units in the holdings of the American Community Power Company of St. Louis.

HENRY I. HARRIMAN has been elected chairman of the board of the New England Power Company, Boston, and Samuel C. Moore has been elected president of that organization, which is one of the most important subsidiaries of the New England Power Association. Col. Charles H. Tenney has been elected a director of the association, Charles L. Edgar being chairman of the latter's board.

B. L. CALKINS has been appointed securities sales manager of the Wisconsin Gas & Electric Company, Racine, Wis., to succeed Grover C. Schmitt.

J. H. Shearer Elected Head of Pennsylvania Utility

J. H. Shearer, vice-president and general manager of the Penn Central Light & Power Company, Altoona, Pa., was elected president of that company, at a meeting of the board of directors held March 20, and of its subsidiary and associated companies, including the Keystone Public Service Corporation and subsidiaries, the Altoona & Logan Valley Electric Railway and subsidiaries, the York Railways Company and subsidiaries and the Chester Valley Electric Company. Mr. Shearer has been connected with the electrical industry practically since its inception, having entered the service of the Thomson-Houston Company in 1890. His early experience with things electrical was obtained in Mexico with Rosenswag & Company, agents for the Westinghouse company in Mexico City; with the General Electric Company in Schenectady and as a member of the construction firm of Gardner & Shearer in Mexico City. Subsequently he organized the Shearer Electric Construction Company, but when the revolution broke out in 1911 he sold his interests and returned to the United States.

He became identified with the public utility industry in the East as general superintendent of the Eastern Shore Gas & Electric Company at Salisbury, Md., and later Day & Zimmermann, managers of the Eastern Shore utility, selected him for the position of general superintendent of the Penn Central Light & Power Company. In 1923 he was elected vice-president in charge of operation and three years ago, when the National Electric Power Company acquired the Penn Central properties, he was appointed vice-president and general manager and a member of the board of directors. Mr. Shearer has been extremely active in technical associations. He served as president of the Pennsylvania Electric Association and as chairman and a member of numerous committees of that body, and he also served on the executive committee of the National Electric Light Association.

Johns-Manville Directors Elect New Officers

At a meeting of the board of directors of the Johns-Manville Corporation held March 15, WILLIAM R. SEIGLE, formerly vice-president in charge of mines and factories, was elected chairman of the board of directors, and LEWIS H. BROWN, formerly secretary and assistant of the president, was elected president. Mr. Seigle succeeds H. E. Manville, resigned, and Mr. Brown succeeds Theodore F. Merseles, who died March 6. Mr. Seigle has been in the service of Johns-Manville since his graduation from college in 1900, at which time the corporation was known as the H. W. Johns Manufacturing Company. His technical training covered the fields of mechanical and electrical engineering, as well as electrochemistry. His remarkable research and development abilities have been responsible for the development of many of the insulating, electrical and building materials upon which the company has based its substantial success. Under Mr. Seigle's leadership the mines and factories making up the manufacturing units of Johns-Manville have been greatly enlarged and improved by the introduction of labor- and time-saving devices. Many new plants have been built, including the important factories located in Asbestos, Canada; Waukegan, Ill., and Pittsburgh, Calif. He is an officer and director in numerous corporations both here and abroad.

A native of Creston, Iowa, and a graduate of the University of Iowa, Mr. Brown engaged in sales work early in his career for a manufacturing company in Indiana. Immediately after the war he joined Montgomery Ward & Company, serving in various departments of the business, including such important responsibilities as those of office manager, superintendent of merchandise and assistant general operating manager of all plants. From 1921 to 1927 Mr. Brown was in close personal contact with the late Theodore F. Merseles, then president, and George B. Everitt, now president of Montgomery Ward & Company, during the remarkable years of the reorganization and revitalizing of Montgomery Ward. These years were devoted to work in planning and carrying

into effect the broad, basic principles of merchandising, marketing and distribution instituted by Mr. Merseles.

Recognizing that in Lewis H. Brown he had developed an able executive with imagination, character and a remarkable ability to handle difficult organization problems, Mr. Merseles selected Mr. Brown to accompany him as his assistant when he became president of Johns-Manville in August, 1927. Mr. Brown is a member of the board of directors of the Fibre Conduit Corporation and many other companies.

W. R. Putnam Resigns

William R. Putnam, vice-president and general manager of the Idaho Power Company, Boise, since 1919, has resigned to take up new work with the Electric Bond & Share Company in New York. Mr. Putnam is especially known in the electrical industry for the comprehensive study of merchandising methods and problems of accounting which he made, having given special attention to electric ranges. In fact, as chairman of the electric range committee of the Northwest Electric Light and Power Association he submitted a report which was the first inclusive document giving accurate data on costs, methods of merchandising and cost accounting of electric ranges.

At the beginning of his career Mr. Putnam spent two years in the banking business, but he relinquished his duties in a Minneapolis bank to enter the public utility industry as manager of the Red Wing Gas & Electric Company. During the ten years he occupied this position he participated in the work of practically every department of the undertaking and thus obtained experience in accounting, purchasing, design and construction engineering. After connections with several electric interests in the Middle Western and Intermountain states, covering a period of ten years, he became sales manager and commercial manager for the Utah Power & Light Company at Salt Lake City. Here his work was essentially of a commercial nature. He left Salt Lake in 1919 to become vice-president and general manager of the Idaho Power Company, the position he has since held. Mr. Putnam has devoted considerable time to association activities in the course of his career. He was one of the organizers of the Minnesota Electrical Association, was active in the Wisconsin Electrical Association and is a past-president of the Northwest Electric Light and Power Association and a past-chairman of the Commercial National Section, N.E.L.A.

JOSEPH JACOBS, formerly superintendent of power of the Columbus Electric & Power Company, Columbus, Ga., has resigned.

C. E. Groesbeck Heads New Electric Bond & Share

C. E. Groesbeck, executive vice-president of the Electric Bond & Share Company since 1927, was elected president of the new Electric Bond & Share Company at the first meeting of the board of directors held March 14. Before coming to New York in 1918 as a vice-president of the Electric Bond & Share Company Mr. Groesbeck had been identified with several of that company's subsidiaries in the West. His early experience was obtained with the organization of H. M. Byllesby & Company, he having spent eight years with their Pacific Coast properties. Early in 1915 he was appointed vice-president and general manager of the Utah Power & Light Company with headquarters in Salt Lake City, as successor to P. B. Sawyer, resigned. At the same time he served as vice-president of the Utah Light & Traction Company and the Western Colorado Power Company. These positions he held until he transferred his interests to the East.

In addition to being head of the Electric Bond & Share Company, Mr. Groesbeck is at the present time president of the American Power & Light Company, the Electric Power & Light Corporation, Power Securities Corporation, Minnesota Power & Light Company and serves on the directorate of the Southeastern Power & Light Company, National Power & Light Company, Utah Power & Light Company, American Gas & Electric Company, Alabama Power Company, Carolina Power & Light Company, Dallas Power & Light Company, Idaho Power Company, and many other corporations.

Obituary

W. L. MOUNTS of Carlinville, Ill., a lawyer and public utility man, died at his home in that city, February 5, after a long illness. Mr. Mounts was one of the pioneers of the electric and gas industry in Illinois. In 1889 he took charge of the Carlinville coal gas plant and under his management electrical equipment was installed. He operated the plant until 1912, when it was sold to the Madison Light & Power Company.

LEONARD WALDO, well-known electrical and metallurgical consulting engineer, died January 26, after a brief illness. Mr. Waldo received his education at Marietta College and Harvard University. During the war he was consulting engineer on illuminants and shells for the War Department, and recently he had been occupied in research work on atomic structure. He has received the medal of the Royal Society of Arts of London for his research work, was a member of the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the Iron and Steel Institute and other technical organizations.

WALTER D. UPTEGRAFF, chairman of the board of directors of the Union Switch & Signal Company and president of the Defiance Paper Company, Niagara Falls, died suddenly February 17 at Niagara Falls. Mr. Uptegraff was born in Pittsburgh and for 50 years he was associated with the Westinghouse Air Brake Company, holding many executive positions under the late George Westinghouse for the various Westinghouse interests.

ISAAC C. WALKER, a pioneer in the electrical industry and at one time an associate of Thomas A. Edison, died at his home near Philadelphia in his eighty-second year. Mr. Walker was a member of the engineering firm of Walker & Ketter. Before removing to Philadelphia Mr. Walker worked at Menlo Park, N. J., with Mr. Edison and was affiliated with the installation of electric light plants in Ohio, Indiana and Kentucky. Mr. Walker was one of the organizers of the Edison Electric Light Company of Philadelphia, now the Philadelphia Electric Company.

PHILIP P. WELLS, authority on the questions of power development, transmission and regulation and on conservation of national resources, died in San Francisco March 13 in his sixty-first year. Mr. Wells was deputy attorney-general of Pennsylvania in the Gifford Pinchot administration, was chairman of the Pennsylvania Giant Power Board of 1925-1926 and a member of the Pennsylvania Giant Power Survey Board of the two years immediately preceding. He was the chief law officer of the U. S. Forest Service from 1907 to 1910 and held the same post with the U. S. Reclamation Service from 1911 to 1913. He wrote many papers on conservation and articles on legal topics in encyclopedias and periodicals. Mr. Wells was born in Grand Rapids, Mich., and was graduated from Yale University in 1889.

JACOB FISCHER, president of the Fischer Electric Company of Denver, Colo., died March 13.

PAUL L. MORGAN, vice-president and manager of A. E. Fitkin & Company, New York, dealers in investment securities, died at his home in Interlaken, N. J., March 5, of pneumonia. In June, 1927, Mr. Morgan resigned as general manager of the Jersey Central Power & Light Company for the North Jersey territory in order to become the personal representative of A. E. Fitkin, well-known developer of public utilities, who later turned to stock brokerage and investment securities. In October, 1927, Mr. Fitkin gave $1,000,000 to establish a hospital and home for crippled children near Freehold, N. J., and appointed Mr. Morgan his representative.

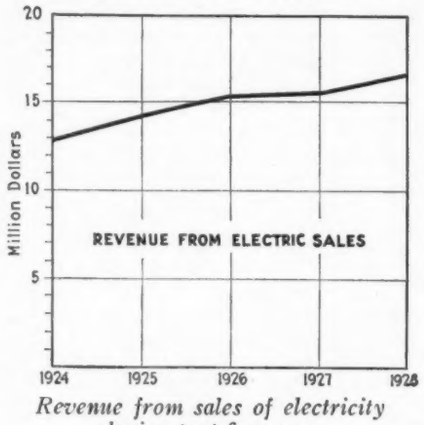
Financial and Statistical News

Baltimore Utility's Electric Business Expands

THAT the Consolidated Gas, Electric Light & Power Company of Baltimore has made a remarkable recovery from the decline reported for 1927 is shown in the year book and annual report just issued, covering operations in 1928, as well as historical data for previous years. It will be recalled that in 1927 the company reported a decline in gross due to a large decrease in electric rates, the prevailing weather conditions and the general industrial and commercial situation. In 1928 total gross operating revenue amounted to $26,126,194, as compared with $24,657,001 in 1927, an increase of 5.96 per cent. Resulting from the expansion of the company's electric business in enlarged territory outside of Baltimore City, the increase in population served and the greater use of electrical equipment, both in domestic and industrial establishments, the revenue from electric sales alone showed an increase of $1,017,280. Operating expenses, including wages, cost of coal, oil, materials, repairs, purchased electricity and gas, accounting, billing, etc., except charges for retirement expense, totaled $12,918,029, against $12,762,456 in the preceding year, an increase of only 1.22 per cent. The increase in net operating and non-operating revenue resulting from operations was $973,659, or 11.81 per cent.

The Consolidated company reports an increase of 34,654,435 kw.-hr. in 1928 for electricity sold, or 4.93 per cent. In 1927 sales of electricity totaled 703,379,370 kw.-hr., while in the following year electricity sales amounted to 738,033,805 kw.-hr. There was also a substantial increase in the number of customers, from 188,888 to 201,983. The accompanying table shows the remarkable electrical development of this utility, and the revenues resulting therefrom.

Expenditures during the year for repairs and maintenance aggregated $1,159,843. Capital expenditures for betterments and extensions to plant and distribution systems and for properties acquired during the year totaled $6,177,238; electrical properties contributed $3,291,893 to this sum. Early in the year the installation of the second large steam-generating unit in the new Gould Street power station was completed and placed in operation. This new equipment brought the company's total electric generating capacity up to approximately 260,000 kw., or 346,000 hp., in addition to the available capacity of the hydro-electric supply from the Pennsylvania Water & Power Company's Holtwood plant on the Susquehanna River, amounting to about 100,000 hp.



Revenue from sales of electricity during past five years

Gross sales of electric and gas appliances and merchandise for the year showed a substantial increase in volume. Sales for the year amounted to $2,939,237, as compared with $2,927,300 for 1927. The consolidated balance sheet as of December 31, 1928, showed total current assets amounting to $14,995,685 and total current liabilities of $2,321,845. The annual report predicts remarkable industrial growth for the city of Baltimore, with this comment:

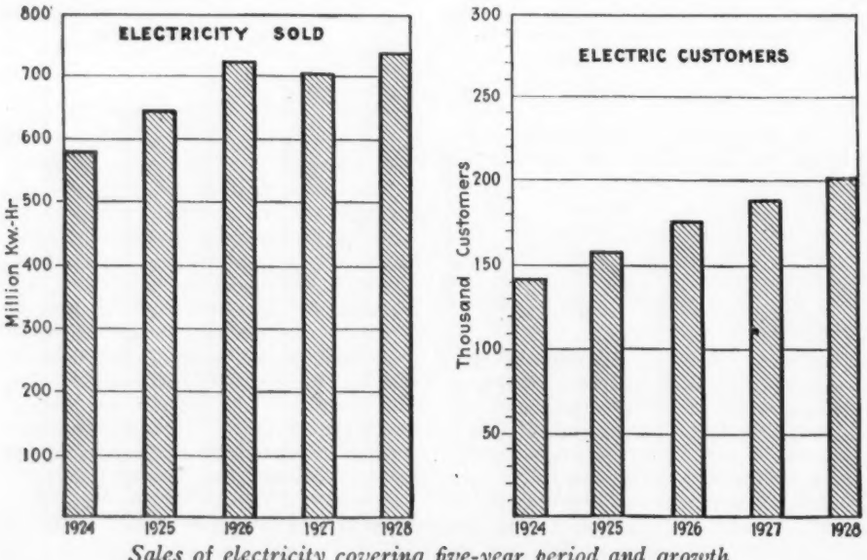
The most recent outstanding recognition of the unsurpassed advantages offered by Baltimore for large industrial operations and the supremacy of the city as an industrial seaport is presented in its selection by the Western Electric Company for the development of one of its largest manufacturing plants. This plant will in a few years employ about 30,000 operatives, bringing an addition of over 100,000 people to Baltimore. The city of Baltimore has acquired land for a large airport situated directly on the harbor and announces that airplane manufacturers arranging for location here warrant the prediction that Baltimore is destined to be the center of airplane production in the East and to benefit greatly by this rapidly growing industry.

Electric Operations

Year	Number of Customers	Current Sales, Kilowatt-Hours
1910	16,605	42,881,697
1915	41,237	145,390,026
1920	79,469	377,613,364
1925	158,608	645,215,639
1928	201,983	738,033,805

Gross Operating Revenue

1910	$4,776,237.91
1915	6,989,849.63
1920	15,433,458.22
1925	22,746,142.72
1928	26,126,194.36



Sales of electricity covering five-year period and growth in electric customers since 1924

American & Foreign Power Bids for Shanghai Plant

The American & Foreign Power Company submitted a bid of $50,000,000 for the purchase of the municipal electric plant of the International Settlement at Shanghai, it was discovered when the bids were opened March 19. This was the highest bid. This action marks the first publicly announced move of the company to secure a public utility property in the Far East, or, in fact, outside of the two American continents.

Application by the American & Foreign Power Company to list additional shares on the New York Stock Exchange revealed the fact that between June 30 and September 30, 1928, that company had acquired fourteen public utility companies in Latin America. The new subsidiaries are: Compañia de Hielo de Cienaga, Compañia de Ser-

vicios Publicos de Santa Marta, Compañia de Hielo de Santa Marta, Empresa de Energia Electrica de Honda of Colombia, Compañia Foca e Lux do Paraña, Empresa de Electricidade de Araraquara of Brazil, Mexican Utilities Company, Guanajuato Power & Electric Company, Central Mexico Light & Power Company, Compañia Hidroelectrica Guanajuatense, Compañia Hidroelectrica Queretana, S. A.; Michoacan Power Company, Compañia de Luz y Fuerza Motriz Electricas de Saltillo, S. A., and Compañia Productora y Abastecedora de Potencia Electrica, S. A.

In addition, American & Foreign Power has acquired the remaining outstanding shares of the Compañia Panamena de Fuerza e Luz and reduced the number of shares held by others in the Compañia Paulista de Forca e Luz and the Compañia Energia Electrica Rio Grandense, both of Brazil.

Thirty-five-Million-Dollar Issue Offered

Gold debentures of the Eastern Utilities Investing Corporation were offered to the amount of $35,000,000 at 98 and accrued interest. These 5 per cent securities were dated March 15, 1929, and mature March 15, 1954. Each one-thousand-dollar principal amount of debenture will carry warrants, entitling the holder to purchase 20 shares of class A common stock at any time after December 31, 1929, and on or before December 31, 1934, at a price of $15 per share.

Central States Declares Stock Dividend

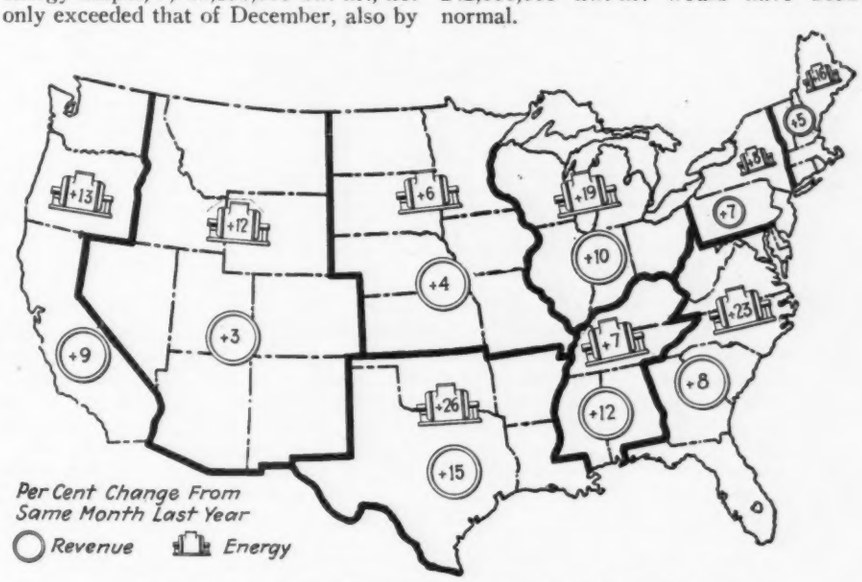
The Central States Electric Corporation at a special meeting of the directors held March 15 declared a stock dividend of 100 per cent in common stock to holders of the common stock of the corporation. A special meeting of the stockholders has been called for March 29 for the purpose of voting upon a proposal to amend the certificate of incorporation of the corporation so as to increase its authorized common stock to 10,000,000 shares. Subject to favorable action by the stockholders at their meeting, the stock dividend of 100 per cent voted by the directors will be paid on April 25, 1929, to holders of common stock of record on April 15. President L. E. Kilmarx said that the more liberal dividend policy of the corporation was warranted by its growth and increase in earnings. In the financial report for 1928 gross income for the year showed an increase of 109 per cent over that of 1927. Net income also increased proportionately, amounting to $7.10 a share on the average number of shares of common stock outstanding, as compared with $3.51 a share in 1927.

Exceptional January Energy Output

Gains 15 per Cent—Total 7,781,251,000 Kw.-Hr.—Dearth of Water Power Forces Extra Billion from Steam—Revenue, $184,400,000, Largest in History

JANUARY operations in the electric light and power industry usually break records; this year is no exception. The revenue, $184,400,000, exceeded that of December, which was the preceding highest month, by 4 per cent and overshot that of the corresponding month last year by 7.4 per cent. The energy output, 7,781,251,000 kw.-hr., not only exceeded that of December, also by 4 per cent, but in addition it passed the output of January, 1928, by 15 per cent. This is an unusually large increase for the interval of a year and indicates a decided upward turn in energy consumption in the country as a whole. The corresponding increments for the preceding four months were, respectively, 11.5, 14.8, 13.2 and 9.5 per cent. On an average daily basis the best showing of 1928 was that of November, but this also was passed in January.

Further evidence of more than normal activity is found in comparing the average daily output with the computed normal, based on past growth. The actual average was 251,000,000 kw.-hr.; 242,000,000 kw.-hr. would have been normal.



All sections shared January increase in light and power

Although in the case of revenue the comparison is not so favorable, the actual average of $5,940,000 per day being somewhat below the estimated normal of $6,050,000, the difference is comparatively small and is readily accounted for by the temporary moderation of the upward movement in energy production in December. On corre-

Table I—Central-Station Financial Operations in the United States

Compared with Corresponding Month of Previous Year

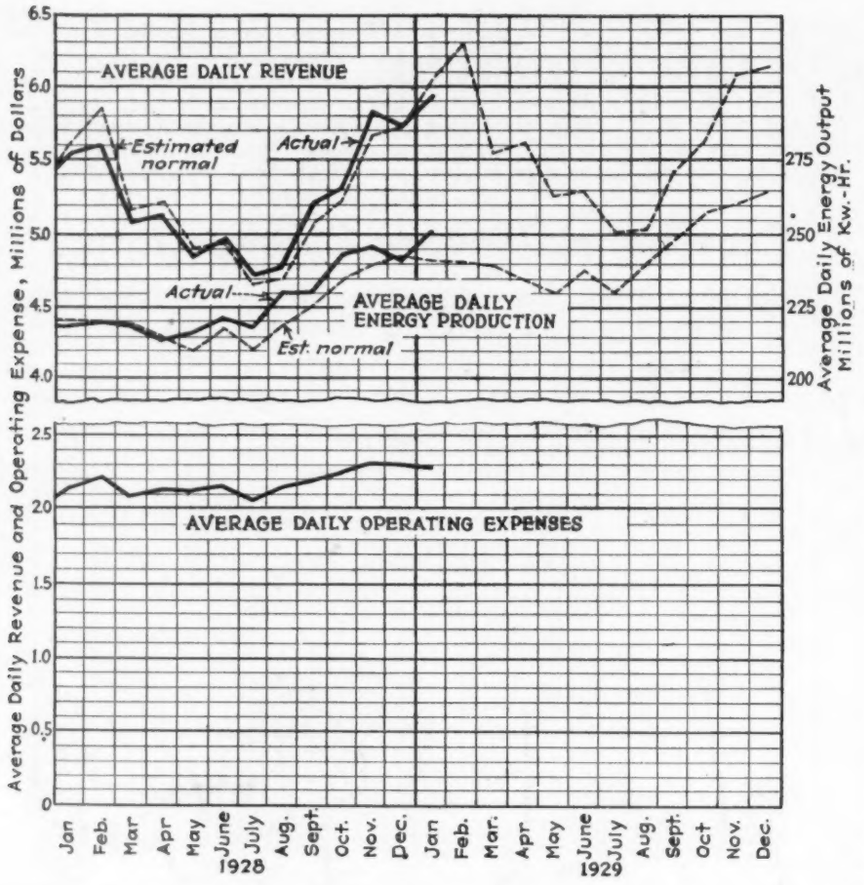
Month	Total Gross Revenue from Sale of Energy*			Total Operating and Maintenance Expenses†		
	1928 Thousands	1927 Thousands	Per Cent Inc.	1928 Thousands	1927 Thousands	Per Cent Inc.
October	164,900	150,800	+ 9.3	69,800	65,100	+7.2
November	174,800	158,200	+10.5	69,200	64,300	+7.6
December	177,600	165,100	+ 7.6	71,800	67,900	+5.7
	1929	1928		1929	1928	
January	184,400	171,700	+ 7.4	71,100	66,700	+6.5

Table II—Central-Station Fuel Consumption in the United States‡

Compared with Corresponding Month of Previous Year

Month	Coal		Oil		Gas	
1928	Short Tons	Per Cent Increase	Barrels	Per Cent Increase	Thousands Cubic Feet	Per Cent Increase
October	3,525,730	+5.8	595,568	+23.2	7,777,704	+21.1
November	3,438,485	+6.2	596,133	+23.1	7,418,675	+31.6
December	3,540,950	+6.0	810,567	+29.8	7,117,793	+48.2
1929						
January	3,763,332	+13.3	845,738	+50.7	8,016,532	+61.8

* Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.
† Do not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions. ‡As collected by U. S. Geological Survey.



sponding grounds the large output in January ought to be reflected in a notably increased revenue for February, when the data become available.

Operating expenses totaled $71,100,000, the percentage rise being somewhat smaller than that of the revenue, with a consequent larger percentage gain in net. Sale of energy to other utilities for resale seems to have decreased, compared with January, 1928. The change was particularly marked on the Coast, and was apparently caused by the extreme scarcity of water power in that part of the country. In other regions, for example New England, a normal increase occurred in the intercompany sales of energy.

Table III—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
1928	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
October	7,548,704	+14.8	2,795,609	+19.0	4,753,095	+12.4	1,360,000	+5.4
November	7,377,887	+13.2	2,718,520	+10.2	4,659,367	+15.0	1,327,000	+7.9
December	7,503,709	+10.2	2,693,409	— 0.1	4,810,300	+17.0	1,320,000	+8.2
1929								
January	7,781,251	+15.0	2,642,873	+ 1.3	5,138,378	+23.5	1,230,000	—2.0

Table IV—Regional Operations, Revenue and Energy Output in January, 1929

Compared with Corresponding Month of Previous Year

Region	Revenue		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	184,500	+ 7.4	7,781,251	+15.0	2,642,873	+ 1.3	5,138,378	+ 23.6
New England	17,180	+ 5.0	521,423	+16.0	174,689	—19.4	346,734	+ 49.0
Middle Atlantic	49,490	+ 7.0	1,905,722	+ 8.4	525,525	— 4.3	1,380,197	+ 14.2
East North Central	42,760	+10.0	2,001,604	+18.6	197,236	+ 1.8	1,804,368	+ 20.7
West North Central	14,320	+ 4.0	439,607	+ 6.4	122,470	+ 3.1	317,137	+ 7.7
South Atlantic	20,820	+ 8.0	971,029	+22.6	465,614	+37.2	505,415	+ 11.6
East South Central	8,020	+12.0	293,546	+ 7.2	228,964	+ 7.3	64,582	+ 6.8
West South Central	9,780	+15.0	385,854	+26.1	8,151	+35.2	377,703	+ 26.0
Mountain	7,340	+ 3.0	308,539	+11.9	262,181	+10.2	46,358	+ 22.4
Pacific	14,790	+ 9.0	953,927	+13.6	658,043	—13.8	295,884	+287.0

*As collected by U. S. Geological Survey.

The lack of water power has become progressively more serious since June, the average daily energy from that source having decreased month by month. In December and January it was virtually the same as it had been the year before. The whole increase, therefore, had to come from thermal plants, and as this amounted to a full billion kilowatt-hours there resulted the extraordinary rise of 23.5 per cent in energy from fuel, and equivalent changes in fuel consumption. The regional distribution of these changes and the various totals for the United States as a whole are given in the accompanying tables. The map shows the gains in revenue and energy output, expressed in per cent, for each of the nine geographical regions.

The January figures are preliminary, subject to revision by the incorporation of some returns not yet received.

Utility Makes Study of Stockholders' Operations

The Associated Gas & Electric System has recently completed one of the most comprehensive analyses ever made of the occupations of the stockholders of any large business enterprise. In checking the occupations of 19,000 stockholders, it was found that approximately 35 per cent of this number were business men and executives, professional people and business organizations and institutions. The analysis involved two separate surveys and covered 160 occupations, which were grouped into fifteen general classifications. In all, 18,933 stockholders were interviewed. The results of both surveys were checked and averaged and then applied to the 68,263 stockholders of the entire system. This number has since increased to over 70,000.

Total number of stockholders..... 68,263

Classification	Per Cent	Number
Housewives	25.9	17,680
Executives and proprietors of business establishments	11.1	7,577
Skilled labor	10.7	7,304
Clerks	8.4	5,734
Professional	8.2	5,597
Associated system employees	7.6	5,188
Unskilled labor	7.1	4,846
Farmers	6.3	4,301
Retired	6.3	4,301
Institutions, societies and business organizations	1.9	1,297
Bankers and brokers	1.8	1,229
Salesmen	1.7	1,160
Students	1.5	1,024
Minor children	0.8	546
City, state and government employees	0.7	479
	100.0	68,263

The accompanying table shows distribution by occupation as of January 1, 1929.

ROCHESTER COMPANY INCREASES DIVIDEND RATE.—The Rochester Gas & Electric Company declared a quarterly payment of 75 cents a common share, placing the issue on a $3 annual basis, against the previous rate of 50 cents quarterly, or $2 annually.

Business News and Market Conditions

Copper in Oil-Burning Installations

Approximately 5,000,000 lb. of copper is consumed annually in the manufacture of oil-burning installations for heating purposes and power production, according to a survey just completed by the Copper and Brass Research Association.

The survey discloses a striking recent exploitation of the field for household oil-heating apparatus. In 1919 the first approved oil heater for homes was listed. Five years later there were less than a dozen approved types. Today some 100 types of domestic oil heaters are sanctioned by the Fire Underwriters.

Sales of these domestic installations now total about 100,000 units per year. The rapid development of the industry is indicated by the fact that domestic oil-burner sales apparently have outstripped automobile sales ten to one over a corresponding initial period of industrial life.

As the potential market for household oil heaters is estimated at 2,000,000 new units, an extensive field for expansion is afforded.

Construction Still Above Last Year's Record

Engineering construction has not only been gaining but has been gaining to the remarkable amount of 27 per cent in the last three months as compared with those same months a year ago, according to the *Engineering News-Record*. January and February recorded cumulative totals of $762,000,000 in contracts awarded, or $351,000,000 more than in those two months of 1928. Comparing the month just past with February, 1928, it is seen that every section except the South, where the values for the two years are the same, and the far West, where there was a drop of 16 per cent, recorded more than unusual advances: New England, 45 per cent; Middle Atlantic, 50 per cent; Middle West, 134 per cent; between the Mississippi and the Rocky Mountains, 48 per cent.

Analysis by classes of construction shows the same unanimity of activity. With the single exception of roads and streets, every class shows a heavy gain compared with February, 1928.

Electrical Manufacturing Widely Distributed

Electrical manufacturing establishments numbered 1,777 in 1927, against 1,739 in 1925, according to a recent report by the Bureau of the Census.

Of the 1,777 establishments reporting for 1927, 298 were located in New York, 258 in Illinois, 206 in Ohio, 137 in New Jersey, 136 in Pennsylvania, 122 in Massachusetts, 115 in California, 70 in Connecticut, 65 in Wisconsin, 60 in Michigan, 58 in Indiana, 52 in Missouri, 29 in Minnesota, 25 in Washington, seventeen in Maryland, fourteen in Rhode Island, twelve in Kentucky, eleven in Texas, ten in Oregon, ten in West Virginia and the remaining 72 in sixteen other States and the District of Columbia. In 1925 the industry was represented by 1,739 establishments, the increase to 1,777 being the net result of gains and losses. Of the establishments gained, some had manufactured commodities other than electrical machinery, apparatus and supplies as their principal products in 1925 and the remainder reported for the first time at the present census. Of the establishments lost, some reported commodities other than electrical machinery, apparatus and supplies as their principal products in 1927 and were therefore transferred to the appropriate industries, some went out of business prior to 1927 and some were idle throughout the year.

Delinquent Electrical Accounts

(Data Supplied by National Electrical Credit Association)

Division	February 1928	February 1929	Per Cent Increase or Decrease	Two Months 1928	Two Months 1929	Per Cent Increase or Decrease
New York	301	217	—27.9	561	415	—26
Middle and Southern Atlantic	183	131	—28.4	342	265	—22.5
New England	121	180	+48.7	254	291	+14.1
Pacific Coast	6	9	+50	17	28	+64.7
Central	796	600	—24.6	1,594	1,194	—25
Total	1,407	1,137	—19.1	2,768	2,193	—20.7

TOTAL AMOUNTS REPORTED

	February 1928	February 1929	Per Cent Increase or Decrease	Two Months 1928	Two Months 1929	Per Cent Increase or Decrease
New York	$39,083	$33,239	—14.9	$88,610	$70,169	—20.8
Middle and Southern Atlantic	27,912	23,343	—16.4	45,423	38,179	—15.9
New England	15,948	27,457	+72.1	30,722	38,382	+24.9
Pacific Coast	1,187	2,962	+149.5	3,120	9,738	+21.2
Central	100,558	75,874	—24.5	201,313	137,854	—31.5
Total	$184,688	$162,875	—11.8	$369,188	$294,322	—20.2

AVERAGE AMOUNTS

	February 1928	February 1929	Two Months 1928	Two Months 1929
New York	$129	$153	$319	$339
Middle and Southern Atlantic	152	178	262	288
New England	131	152	242	250
Pacific Coast	198	329	373	685
Central	126	126	252	230

Value of Contracts by Sections in the United States and Total for Canada, February, 1929

Thousands of dollars (-000 omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Jan. 1 to Date	Canada
Water-works	$79	$385	$768	$2,508	$729	$195	$4,664	**$7,455**	.....
Sewers	142	1,917	324	2,304	301	374	5,362	**11,641**	$92
Bridges	23	1,070	119	3,506	817	41	5,576	**13,244**	500
Excavations, etc	.....	82	40	400	134	151	807	**11,864**	500
Streets and roads	170	2,311	2,120	777	5,459	1,292	12,129	**43,309**	414
Industrial buildings	1,935	12,762	7,398	12,568	11,497	1,980	48,140	**125,788**	7,458
Commercial buildings	10,394	102,896	6,404	82,147	10,165	21,249	233,255	**382,720**	3,682
Federal government	.....	316	1,047	315	1,056	1,238	3,972	**12,514**	.....
Unclassified	50	4,567	166	289	21,610	24,196	50,878	**153,071**	1,461
February, 1929*	12,793	126,306	18,386	104,814	51,768	50,716	364,783	.....	14,107
January, 1929†	27,073	156,358	20,953	52,311	100,577	39,561	396,833	.....	11,247
February, 1928*	9,020	84,820	18,962	45,281	34,706	20,501	213,290	.....	4,644
Year to date, 1929	**39,866**	**282,664**	**39,339**	**157,125**	**152,345**	**99,277**	.....	**761,616**	25,354
Year to date, 1928	26,360	157,624	38,039	85,561	66,387	37,303	.....	411,274	17,319

*Four weeks. †Five weeks.

Market Conditions

——NINETEEN-TWENTY-NINE ought to be a record year in the electrical manufacturing industry if current indications are dependable. Demand for equipment has taken on a decidedly better aspect throughout the East than was anticipated at the beginning of the year. Power companies are making exceptionally heavy purchases of substation apparatus.

——Middle West business has improved steadily, if not so rapidly as in the East. Inquiries indicate satisfactory spring and summer volume.

——On the Pacific Coast the advance in the price of copper is a disturbing factor, but acts as an inducement to buyers, who anticipate still higher levels in many lines.

Substation Equipment in Good Demand in Southeast

The feature of activities in the Southeast was the demand for substation equipment, most of the orders coming from a Georgia central station, though one satisfactory order was received from the Birmingham territory. Oil circuit breaker equipment totaling $125,000 was ordered for three substation jobs, while large power transformers purchased for two substations amounted to $105,000. A Georgia company purchased four 12,000-kva. transformers, while an electric distributing company in Alabama ordered regulating transformer equipment amounting to $25,000. This same Georgia company's miscellaneous orders for distribution and small power transformers aggregated $23,500. Another interesting power company order was for a 15,000-kva. condenser, while some smaller orders were for pin type insulators amounting to $5,000, lead covered cable totaling $4,700 and house type meters costing $3,600. One of the smaller companies in Georgia ordered two carloads of creosoted pine poles and one carload of crossarms. The United States Penitentiary at Atlanta placed an additional order for pole line materials amounting to $1,000, while the Fruit Growers Express ordered $1,000 in wiring supplies for a new icing station. Construction projects are as follows:

The Lonsdale Company will construct a $250,000 textile plant at Gainesville, Ga. The Virginia East Coast Utilities, Inc., Richmond, Va., plans extensions in transmission lines to Reedville, Heathsville Avalon, Va., and vicinity. The Ken-Rad Tube & Lamp Corporation, Owensboro, Ky., plans an addition to its radio equipment plant, to cost $100,000. The Davenport Hosiery Mills, Chattanooga, Tenn., plan expansions to cost $200,000. Greenville, N. C., contemplates an ornamental lighting system. The Southern Public Utilities Company, Charlotte, N. C., plans extensions in transmission lines in vicinity of Pilot Mountain, N. C. The Rockhill Printing & Finishing Company, Rockhill, S. C., plans a bleachery to cost $1,000,000. The Gulf States Steel Company, Birmingham, Ala., plans additions in its mill at Gadsden, Ala., to cost $3,500,000. The Crane Company, Chicago, plans a pipe and steam specialty factory branch and distributing plant at Jacksonville, Fla., to cost $100,000. Bartow, Fla., contemplates a flood lighting system and beacon lamps.

Small Orders and Negotiations Increase in New England

The demand for small motors continues actively in the New England district. Switch and control apparatus are selling well and negotiations for turbo-generators are being closed. Substation equipment consisting of transformers, circuit breakers, oil switches and insulators are receiving attention and several sales are reported, while line material is commanding interest. Industrial equipment orders are at present confined to small motors, and recently orders were placed for two lots, one for motors amounting to $2,000 and another for a group totaling $2,400. Small switch sales are active and scheduled material is moving steadily. Transformer orders recently reported include a bank of 100 kw., a bank of 1,500 kw., and a 7,500 kva. unit to be delivered for new additions for southern New England stations. Orders for guying cable are being received, line hardware, crossarms and poles are gaining in attention and orders for two electric heating furnaces to be used in steel treatment were closed recently. Construction projects are as follows:

The Bureau of Yards and Docks, Navy Department, Washington, is asking bids (no closing date specified) for remote control equipment for electric-operated centrifugal pumps for the Boston, Mass., navy yard (Specification 5807). The Intercontinental Pipe & Mining Company, 475 Fifth Ave., New York City, plans a cast-iron pipe-manufacturing plant at Chelsea, Mass., to cost $2,000,000. The Seamless Rubber Company, New Haven, Conn., will build an addition to its power plant to cost $25,000. The L. & H. Motor Company, Hartford, Conn., will build a service and

Principles of Business Conduct

FOLLOWING the statement in previous issues of general principles of good business, including relations of manufacturers to customers, agents and others, as indorsed by the board of governors of the National Electrical Manufacturers' Association, there are here presented principles advocated by that organization governing the relation of manufacturers to each other:

1. The manufacturer's salesmen should be persons of known high character. Their reports should be based only on the facts surrounding the transaction or condition in question.

2. Comparisons favorable to one's own product are justifiable if they are confined strictly to truthful statements. But neither generally nor specifically disparaging statements concerning a manufacturer or his product should be made beyond those involved in a clear-cut comparison of similar facts. It is proper to make comparison of one's product with that of a competitor when such comparison is based on information secured through bulletins available to the public, articles appearing in the public press, information derived from the reports of competent, independent testing organizations, or upon data which can be readily verified by the prospective purchaser, such, for instance, as weights and dimensions.

3. It is often difficult to distinguish between failures of apparatus by reason of defects in workmanship or design and those due to other causes; for example, abuse or misapplication on the part of the customer. Therefore, it is not ethical to draw the attention of a purchaser to the supposed failure of a competitor's line or type of product even although occasional instances of such apparent failure may have been reported.

4. Rumors concerning the financial standing or credit of a competitor or in general any rumor disparaging to a competitor should not be repeated.

5. Calling attention to the respective prominence and magnitude of manufacturers is proper. This is advantageous to the smaller manufacturers in some cases and to the larger manufacturers in others, depending on the locality, size of equipment produced, or character of installations made, or possibly to the special peculiarities of relationship of the customer to the manufacturer or to his own trade.

6. As a matter of courtesy, one manufacturer should not endeavor to secure the employees of another without first notifying him.

7. The electrical manufacturers indorse the development of standardization of their products and urge all to conform to the minimum standards recommended.

repair, and headquarters unit, to cost $300,000. The Wallace Barnes Company, Bristol, Conn., will build additions to its steel spring plant to cost $400,000. Greenfield, Mass., will spend $40,000 for a new airport. The Hartford Electric Light Company, Hartford, Conn., plans to spend $277,725 for overhead wires and cables, conduits, etc.

Orders Continue to Increase in Eastern District

Business continues to register high for electrical equipment in the Eastern district. Orders are maturing at a pace unanticipated a few weeks ago, with inquiries in a volume to give assurance of the present rate of activity well into the spring season. Central stations are making exceptionally heavy purchases of substation apparatus and commitments for other equipment are good. A power company in Virginia has contracted for transformers, condensers and oil circuit breakers with a New York maker to an amount of $150,000. A New Jersey central station has given a commitment to a Pennsylvania manufacturer for similar equipment to the sum of $300,000. A metropolitan utility company has ordered a quantity of transformers and network protectors to cost $240,000. A power station in Carolina has purchased transformers, condensers and miscellaneous switching equipment to cost $150,000. In the line of prime movers, a Texas central station has given a large award to a Pennsylvania manufacturer, covering a 25,000-kw. turbo-generator, with auxiliary equipment. A municipality in Kentucky has placed a contract with a New York maker for a 600-kw. generating unit, the order for a reciprocating engine being placed with a Pennsylvania manufacturer. A central station in southern New Jersey has purchased a condenser to cost $75,000.

Industrial account closely follows the central station demand. Fractional-horse-power motors are recording a satisfactory volume of business. A manufacturer of compressors in Connecticut has placed an order for motor units of this kind with a New York maker to an amount of $30,000. A maker of control equipment reports an increase of 30 per cent in business for the first two months of the year, compared with the corresponding period of 1928. Railway account is lagging and not much is expected from this quarter for several months. The New York municipal subway, however, is expected to place large commitments for equipment within 60 days. A metropolitan contracting company has placed an order for a gas-electric locomotive to cost $140,000 with a New York manufacturer. A manufacturer of switches and panels says that orders for the first two months of the year show an advance of 15 per cent over the same period of last year. Construction projects are as follows:

The DeLaval Separator Company, Poughkeepsie, N. Y., will build an addition to cost $150,000. The Allied Die-Casting Corporation, Brooklyn, will build a plant at Long Island City to cost $350,000. The Nitrogen Engineering Corporation, New York, plans a synthetic ammonia fertilizer plant in Russia to cost $10,000,000, and orders for equipment will be placed here. The New York Power & Light Corporation, Albany, contemplates a hydro-electric power project at Conklingville, N. Y., to cost $650,000. The Rochester Gas & Electric Corporation, Rochester, N. Y., plans an addition to its byproduct coke plant to cost $1,200,000. The Continental Can Company, Syracuse, N. Y., will make extensions to cost $75,000. The United States Signal Corps, Fort H. G. Wright, N. Y., will receive bids until April 1 for 24,000 ft. of cable (Circular 2). The World Cleaners & Dyers, Inc., Mount Vernon, N. Y., will build a plant to cost $200,000. The Walter Kidde Company, Bloomfield, N. J., will build an addition to its fire extinguisher plant to cost $60,000. The Brunswick Laundry Company, Jersey City, N. J., plans a power plant to cost $125,000.

The Philadelphia & Reading Coal & Iron Company, Philadelphia, plans a steam-operated electric power plant at Herndon, near Sunbury, Pa., to cost $5,000,000. The Edgcomb Steel Company, Philadelphia, will build a storage and distributing plant to cost $200,000. The General Electric Company, Philadelphia, plans an automobile service and garage building to cost $150,000. The Pennsylvania Power Company, Sharon, Pa., plans an outdoor power substation at New Castle, Pa., to cost $185,000; also, an equipment storage and distributing plant at Sharon, to cost $100,000. The Standard Steel Propeller Company, Pittsburgh, contemplates an expansion program to cost $350,000. The Consolidated Gas, Electric Light & Power Company, Baltimore, Md., will build transmission lines in Carroll County. The Potomac Edison Company, Hagerstown, Md., will build an addition to its power substation at Cumberland, Md., and will build a steel tower transmission line from the latter place to the Lake Lynn generating plant of the West Penn Power Company. The Potomac Electric Power Company, Washington, D. C., will build two substations, to cost $150,000 and $70,000, respectively.

Good Volume of Buying in St. Louis District

Activity in stock sizes of apparatus has held up to the former level in the St. Louis district. Oil-producing companies are still buying line material and equipment for pumping wells. Central-station programs are being carried out following the contracts that were placed, including a synchronous motor and a switchboard for an ice company costing $10,000, oil circuit breakers to cost $8,000 for one of the power companies, a condenser of 2,500 kw. capacity, a turbine costing $15,000, one 500-kw. and one 333-kw. generator for engine drive costing $9,000 and a lot of medium-sized motors for a mining company costing $3,000. Construction projects are as follows:

The Liquid Carbonic Company, Chicago, will build a factory branch and distributing plant at St. Louis, to cost $100,000. Miami, Okla., plans an ornamental lighting system to cost $25,000. Lang & Witchell, Dallas, Tex., architects, have plans for a public market, with cold storage and refrigerating system, power house, etc., to cost $1,700,000. The Southern Pine Lumber Company, Texarkana, Tex., plans a mill at Clarksville, Tex., to cost $100,000. Brady, Tex., plans a floodlighting system and beacon lamps. Austin, Tex., plans extensions in its municipal power plant to cost $400,000. The San Antonio Public Service Company, San Antonio, Tex., will make extensions in its ice plant at Seguin, Tex., to cost $30,000. The San Antonio Power & Light Company, San Antonio, Tex., plans a power substation at Fentress, Tex., to cost $30,000. Austin, Tex., plans an ornamental lighting system in the Lamar Park district. The Grayburg Oil Company, San Antonio, Tex., plans a refining plant at South San Antonio, to cost $1,000,000. Shreveport, La., plans a floodlighting system and beacon lamps. The Vacuum Oil Company, Lake Charles, La., will build an addition to its storage and distributing plant to cost $100,000.

Utility Buying Active in the Middle West

The volume of business is substantial and well diversified, with a noticeable improvement in industrial and building activities, in the Middle West. The steel, automotive, agricultural and railroad industries are in an excellent position with every prospect for a continuance of the present prosperous condition. The utility companies are busy with quite a large amount of construction work, while maintenance purchasing has been rather heavy, one large utility company averaging $105,000 per day. Interesting orders that have been placed include one for 750,000-circ.mil and 1,000,000-circ.mil paper and lead-insulated cable valued at $300,000, 3,000 5-amp. watthour meters, 965 Thompson meters, 5 to 2,000 amp. capacity, "Mazda" lamps valued at $250,000 and several construction orders aggregating $150,000. Jobbers' sales continue to show improvement. Construction projects are as follows:

The Sparks-Withington Company, Jackson, Mich., will build an addition to its radio equipment plant to cost $150,000. The Bowman Dairy Company, Chicago, Ill., plans a pasteurizing and bottling plant at River Forest, Ill., to cost $175,000. The Thorn Motors Corporation, Chicago, Ill., plans a plant for manufacture of electric-gasoline delivery trucks, to cost $100,000. The Continental Steel Corporation, Kokomo, Ind., will build an addition to cost $250,000. Purdue University, West Lafayette, Ind., plans a mechanical engineering building to cost $150,000, a pharmacy building to cost $125,000 and a chemistry building to cost $300,000. The Kapehart Automatic Phonograph Company, Fort Wayne, Ind., plans a factory to cost $65,000. The Dayton Rubber Company, Dayton, Ohio, will build an addition to cost $150,000. The Ohio Electric & Controller Company, Cleveland, will build an addition to its lifting magnet plant to cost $100,000. The Rubel Baking Company, Cincinnati, Ohio, will build a baking plant to cost $200,000. The Toledo Seed & Oil Company, Toledo, Ohio, plans a linseed oil mill to cost $100,000. The B. F. Goodrich Company, Akron, Ohio, plans a rubber mill at Atlanta, Ga., to cost $4,500,000. The Pure Oil Company, Columbus, Ohio, will build a storage and distributing plant at Cincinnati, Ohio, to cost $90,000. Sears, Roebuck & Company, Chicago, plans a branch plant at Cincinnati, Ohio, for storage and distributing service, to cost $400,000. The Gustavus Adolphus College, St. Peter, Minn., plans extensions in its power plant to cost $50,000. Breckenridge and Winona, Minn., La Crosse, Wis., and Lincoln, Neb., plan ornamental lighting systems. The Board of

Education, Lincoln, Neb., plans an equipment storage and distributing plant with electrical and mechanical repair facilities, to cost $175,000.

Copper Price Rise Factor in Pacific Coast Business

Electrical business continues to be featured by the rapid rise of copper on the Pacific Coast. The local office of the Allis-Chalmers Manufacturing Company reports orders of approximately $300,000 for copper mine equipment comprising grinding machines and 200-hp. slow-speed synchronous motors for shipment to Nevada, Utah and Arizona. The Southern Pacific reports copper wire jobs aggregating 660 miles and providing for four-wire circuits between Klamath Falls and Alturas and two-wire circuits connecting Tracy and Martinez and Fresno and Bakersfield. Manufacturers report excellent business in distributing transformers and they also report a fine business in pumping motors for the Central valley district, and especially in the Bakersfield area.

Promising sales in industrial motors are forecast by many quotation requests from such industrials as steel, woodworking and packing plants. The General Electric Company reports an order for 75 motors, sizes 5 to 20 hp., for a remodeled packing plant. Power company orders include one carload of high-tension insulators for the San Joaquin valley, a $3,000 switchboard for a San Francisco steam plant, a carload of 4-in. fiber conduit for Los Angeles and 5 miles of power and telephone lines for the West Stanislaus irrigation district.

The board of contracts and awards, Tacoma, Wash., is taking bids until April 18 for furnishing machinery and equipment for the Lake Cushman hydro-electric unit No. 2, including one or two 37,500-hp. hydraulic turbines, one or two 30,000-kva. electric generators, four or six 20,000-kva. transformers, three or six 14,100-kva. transformers, three 6,667 kva. transformers, one 3,333-kva. transformer and one 15,000-kva. synchronous condenser. Sales last week included 500 hp. in motors, ranging from 100 hp. down for a Willapa Harbor lumber mill, about $6,000 in motors, ranging from 100 hp. down, to cold storage plants and a mine and numerous scattered small-sized machines to lumber mills and woodworking plants. Specifications are out for fifteen motors of from 100 hp. down for a proposed electrified mill near Seattle and for motors for a $300,000 cold storage plant in Tacoma. The Grays Harbor Railway & Light Company interests, Aberdeen, Wash., will start construction within 30 days on a 35-mile, 66,000-volt transmission line from Aberdeen to Raymond, Wash., costing $400,000. A municipal lighting plant is considered at Pullman, Wash. The Pacific Power & Light Company, Walla Walla, Wash., plans an outdoor substation, involving a 3,000-kva. transformer and switching equipment. A contract for a street-lighting system costing $35,900 was let in Everett, Wash. Construction projects are as follows:

The Signal Section, Signal Corps, General Depot, San Francisco, will receive bids until March 30 for 12,200 ft. of 2-in. conduit (Circular 70). Los Angeles, Huntington Beach, Ukiah, Beverly Hills and Placentia, Calif., plan ornamental lighting systems. The Pacific Electric Railway Company, Los Angeles, plans a substation on the Glendale Boulevard, to cost $80,000. The Coos Bay Lumber Company, Marshfield, Ore., contemplates a pulp and paper mill to cost $2,000,000. Pendleton, Ore., Wallace, Idaho, Port Angles, Lynden, Mount Vernon and Enumclaw, Wash., plan ornamental lighting systems. The General Mills, Inc., Minneapolis, Minn., plans a grain elevator at Great Falls, Mont., to cost $400,000. The Terminal Cold Storage Company, Phoenix, Ariz., will build a cold storage and ice plant to cost $450,000. The contracts for tunnels, hydraulic and electrical machinery and other power plant equipment are to be let immediately by the British Columbia Electric Railway Company, Ltd., Vancouver, B. C., in connection with its power development project at Ruskin, B. C., on the Stave River.

Copper Jumps to 23 Cents Other Metals Strong

A sensational advance in copper, lead, and zinc featured the metal markets in the week ending today. Copper advanced 5 cents to 23 cents a pound late today; and as high as 8 cents, New York, was paid for lead, and 6.60 cents for zinc, compared with 7¼ and 6.35 cents respectively a week ago. Zinc sales were particularly heavy.

NEW YORK METAL MARKET PRICES

	Mar. 13, 1929 Cents per Pound	Mar. 20, 1929 Cents per Pound
Copper, electrolytic	20	23
Lead, Am. S. & R. price	7.25	7.875
Antimony	9⅛	9.75
Nickel, ingot	35	35
Zinc, spot	6.35	6.825
Tin, Straits	48.63	49
Aluminum, 99 per cent	24.30	24.30

Base copper wire price March 20, 1929, 24¼ cents

Activities of the Trade

Anaconda Wire & Cable Buys Inland Wire & Cable

An announcement has been made that stockholders of the Inland Wire & Cable Company have accepted the offer of the Anaconda Wire & Cable Company, a subsidiary of the Anaconda Copper Mining Company, and have voted to transfer all the property and assets of the Inland company to the Anaconda Wire & Cable Company in exchange for 102,800 shares of the capital stock of the latter company. The Anaconda Wire & Cable Company has an authorized capitalization of 1,000,000 no-par shares, of which 223,478 will be outstanding upon completion of this transaction. The Inland Wire & Cable Company has 102,800 shares outstanding.

The following are the officers of the new company: H. Donn Keresey, president; Harold V. Engh, vice-president, and W. K. Daly, secretary and treasurer. The board is composed of Mr. Keresey, Cornelius F. Kelley, Benjamin B. Thayer, Mr. Engh and W. H. Mitchell.

Mine Safety Appliances Co. Gets Cecil G. Rice Trophy

The Mine Safety Appliances Company, Pittsburgh, Pa., was awarded the Cecil G. Rice safety trophy at the annual banquet of the safety school conducted by the Western Pennsylvania Safety Council, which was held at Syria Mosque March 11. The banquet was attended by more than 1,800 men and women from the industrial plants of the Pittsburgh district who had completed the safety lecture course.

The Cecil G. Rice trophy is awarded annually to the company in western Pennsylvania having the best safety record for the previous year and is much sought after by all member companies of the National Safety Council. The announcement that the Mine Safety Appliances Company had won the award this year was received with great enthusiasm as this company is dedicated to safety, being engaged entirely in the manufacture of safety appliances. There is considerable hazard involved in its work as it has to do largely with providing protection against poisonous and explosive gases. It is continually working with these gases and many of its employees are engaged in the dangers of rescue and recovery work after mine explosions and mine fires. In view of this, the winning of the safety trophy by this company is regarded as an accomplishment.

Maytag Company Report

Net income of $5,336,710 is reported for the calendar year 1928 by the Maytag Company. After depreciation and federal taxes, this is equivalent to $2.84 a share on the common stock after preferred dividends. In 1927 the company reported net equivalent to $3.84 a share on the common stock then outstanding.

Fairbanks-Morse Annual Report

Net billings to customers for the twelve months ended December 31 by Fairbanks-Morse & Company amounted to $30,542,420, against $28,398,416 for 1927. This is an increase of 7.6 per cent. Total orders received during the same period aggregated $31,984,904. The increase in business shown was well distributed over the different sales territories with the exception of the

Southern States, where transactions were below normal as a result of local conditions. Foreign business continued to show satisfactory growth both in volume and in more extended coverage.

On account of the increase in the sale of large equipment to municipalities and others on extended terms the company early in the year organized its own finance company under the title of the Municipal Acceptance Corporation, with which it is now discounting its long term receivables.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY announces that L. A. Etienne and R. L. Duval, both of its St. Louis office, were transferred to the Denver territory. Mr. Etienne succeeds Murray Graff, who resigned, and Mr. Duval replaces J. P. Sprunt, who was promoted to a position in Salt Lake City. A. F. McCallum, who was formerly manager of the service department, is now located in Houston, Tex., due to a promotion, and he is succeeded by G. R. Fickel of Denver.

THE MILLER COMPANY, Meriden, Conn., manufacturer of lamps and lighting fixtures, announces that its New York office and show-room is now located in the Scientific American Building at 24 West 40th Street.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, manufacturer of electrical instruments and circuit breakers, announces that Jackson Brown, Jr., 701 Kittridge Building, Denver, Colo., has been made representative for the company in Colorado, Utah, Wyoming and northern New Mexico. The Manila Machinery & Supply Company, Inc., Manila, P. I., is representing the company in the Philippine Islands.

THE IDEAL COMMUTATOR DRESSER COMPANY, Sycamore, Ill., announces that it has placed on the market its line of fuse pullers, which are made in four different sizes.

SCHWEITZER & CONRAD, INC., 4421 Ravenswood Avenue, Chicago, manufacturer of high-voltage protective and switching equipment, announces that J. M. Livingston has become associated with its company, in the capacity of sales manager. Mr. Livingston was formerly sales manager for the Electric Power Equipment Company of Philadelphia.

THE RILEY STOKER CORPORATION, Worcester, Mass., announces that L. F. Lang has been appointed assistant to M. L. Cornelious at its Cincinnati office and K. E. Pote has been appointed district manager of its Pittsburgh office to succeed E. H. Schmitz, who has been appointed district manager of its Boston office.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received an order from the Albermarle Chesapeake Corporation of West Point, Va., for the electrical equipment for a new unit of its plant. The order includes two turbo-generators, one a 2,500-kw. condensing unit and the other a 1,500-kw. non-condensing unit; a surface condenser, a complete switchboard and a sectional electric drive for a 240-in., 100-850-f.p.m. Pusey & Jones Fourdrinier paper machine. The company has also received an order from the Stanley Works of the American Tube & Stamping plant at Bridgeport, Conn., for five synchronous motors of from 700 to 1,400 hp. and two variable speed SK motors of 100 hp., together with the necessary control equipment for these motors.

New Equipment Available

Relay Actuates Signal in Alarm Circuits

A new relay labeled CR-2810-1245, for use on various types of alarm circuits, has been devised by the General Electric Company. The product is of the normally closed type and functions to actuate a warning signal on the failure of power. It is strongly built, of simple construction, and operates very quietly. The contact construction is of the silver-to-silver type and is double break. It is made in standard ratings.

Applications of the relay are expected to be many and various, ranging from simple failure of power, when no more serious consequences result, to more involved circumstances, where power failure would result in serious consequences, such as the failure of heat in an incubator. The warning signal controlled by the relay may be a bell, a horn, a whistle, a light, or any other common device, and would probably be energized by batteries.

New Type Lamp Removes Blackening Difficulties

The development of a practical method for removing the black deposit that gradually collects on the inner surface of high-powered incandescent lamps has been announced by the lamp development laboratory of the incandescent lamp department of the General Electric Company in Cleveland. The development should have a bearing on aviation and motion-picture production, where high-powered and high-efficiency incandescent lamps play important rôles.

Bulb blackening has always been a significant factor in determining the useful life of all incandescent lamps, and owing to the large filament in high-intensity gas-filled lamps the factor has been most important. The rising gas in such a lamp carries along evaporated tungsten which is deposited on the cooler top and sides of the bulb. This tungsten soot both absorbs considerable light and radiates heat. In time the glass undergoes devitrification, and finally the glass becomes so hot that the bulb is ill-shaped and useless.

The new deposit remover is a tablespoonful of coarse tungsten powder placed inside the lamp before it is sealed. After the lamp has become blackened from use the operator needs but to remove the lamp from its socket, invert it and sweep the filament deposit off the inner glass surface, restoring the lamp to its former efficiency. With the bulb-blackening difficulty practically removed, the lamp filament may be heated much nearer to its melting point without endangering the bulb and without shortening the customary 100-hour life for which the lamps are designed.

The new method of cleaning the inside of the bulbs has been applied to several high-intensity lamps, including the 1,500-watt, 32-volt; the 3,000-watt, 32-volt; the 5,000-watt, 115-volt, and the 10,000-watt, 110-volt lamp for aviation service, as well as the 5,000- and 10,000-watt, 115-volt lamps for motion-picture studios.

New Design Polyphase Switch

A new design polyphase meter service switch, of which the blade construction provides a double break, materially increasing the current interrupting capacity and decreasing the size of the slate and box, is announced by the Trumbull Electric Manufacturing Company, Plainville, Conn. The meter testing type is provided with removable test links which, together with fuses and blades, are all mounted on the top of a single slate, easily accessible for testing or inspection.

The design of the new switch is furnished in 30 to 200 amp., 230 volts alternating current for the following service: Three-wire, three blades, three fuses with two sets of test links; four-wire, three blades, three fuses with neutral terminal and three sets of test links.

Switches having accessible fuses are equipped with an interlocking device so that the fuse compartment slide cannot be opened until the switch is pulled off. Bases are of slate. The contacts are of double break blade construction, the blades being operated from the back of the slate. Line terminals are at the bottom and all connections are at the front and straight through to the meter. Meter testing facilities are provided above the switch in an easily accessible location.

A TOTALLY INCLOSED SWITCH, to prevent plaster and dirt from getting into the mechanism when it is installed and before decorating has been completed, is being manufactured by the General Electric Company, merchandise department, Bridgeport, Conn. This design uses standard flush switch mechanisms and fits standard outlet boxes.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 5, 1929)

17,230 (reissue). TRANSFORMER TAP-CHANGING DEVICE; H. A. Travers, Forest Hills, Pa. App. filed June 16, 1926.

1,703,899. METHOD OF ELECTRICALLY WELDING A DRILL; H. Petley, Akron, Ohio. App. filed May 28, 1925.

1,703,906. ELECTRIC COUPLER DEVICE; R. R. Stevens, Forest Hills, Pa. App. filed Sept. 13, 1927.

1,703,934. ELECTRIC-CURRENT CONVERTER; N. M. Hopkins, New York, N. Y. App. filed Dec. 20, 1920.

1,703,953. ELECTRICAL ATTACHMENT PLUG; H. Propp, New York, N. Y. App. filed July 28, 1925.

1,703,976. ELECTRIC-SOCKET COVER; J. Williamson, Chicago, Ill. App. filed April 22, 1925.

1,703,988. SWITCH FOR ELECTRICAL APPLIANCES; C. L. Cameron, Dayton, Ohio. App. filed June 17, 1927.

1,703,997. ELECTRIC RIVETING HAMMER AND DRILL; P. Greenwood, West Haven, Conn. App. filed April 27, 1927.

1,704,005. INSULATOR MOUNTING; B. Katzenberger and T. Jansen, Mannheim, Germany. App. filed Aug. 22, 1927.

1,704,021. ELECTRIC CIRCULATING HEATER; W. Schott, Hanover, Germany. App. filed March 21, 1928.

1,704,104. TRAFFIC SIGNALING SYSTEM; J. J. Ruddick, West Newton, Mass. App. filed Dec. 15, 1920.

1,704,125. METAL PLATING NON-METALLIC SUBSTANCE; H. C. Fisher, Cincinnati, Ohio. App. filed April 12, 1924.

1,704,127. ELECTRIC FOOT WARMER; W. W. Hicks, San Francisco, Calif. App. filed July 8, 1926.

1,704,151. SPOOL FOR ELECTRICAL INSTRUMENTS AND THE LIKE; R. Simpson, River Forest, Ill. App. filed July 18, 1927.

1,704,162. CURRENT METER; C. H. Au, Washington, D. C. App. filed Oct. 17, 1925.

1,704,176. ELECTRIC SWITCH; R. H. Cunningham, Jackson, Mich. App. filed July 15, 1927.

1,704,191. PRESSURE-OPERATED SWITCH; F. J. Heideman, Detroit, Mich. App. filed Sept. 21, 1925.

1,704,215. APPARATUS FOR VARYING THE ELECTROMAGNETIC CONSTANTS OF SLOW-SPEED COILS; O. C. Roos, New York, N. Y. App. filed Dec. 28, 1925.

1,704,233. MINING MACHINE; C. W. Wyman, Claremont, N. H. App. filed July 1, 1925.

1,704,247. PROCESS OF AND APPARATUS FOR MAKING METAL SHEETS; H. C. Harrison, Lockport, N. Y. App. filed Dec. 4, 1923.

1,704,270. ELECTRICAL COOKING DEVICE; G. F. Wells, San Francisco, Calif. App. filed Oct. 18, 1927.

1,704,288. AUTOMATIC CIRCUIT INTERRUPTER; G. Hesse, Los Angeles, Calif. App. filed Feb. 18, 1922.

1,704,289. HUMIDIFIER; G. C. Hoffman, Washburn, N. D. App. filed Jan. 13, 1927.

1,704,300. ELECTRIC-CIRCUIT CONTROLLER; L. H. McCarron, Sierra Madre, Calif. App. filed April 28, 1926.

1,704,302. ELECTRIC PRECUSSION FUSE; H. Rühlemann, Sommerda, Germany. App. filed April 16, 1928.

1,704,305. CLAMP FOR ELECTRIC CONDUCTORS; N. I. Smith, Altoona, Pa. App. filed Aug. 4, 1928.

1,704,331. CONTROL SYSTEM FOR ELEVATORS; G. W. Lautrup, Yonkers, N. Y. App. filed Feb. 1, 1926.

1,704,336. BATTERY TERMINAL; W. O. Parson and J. F. Smith, Geneseo, Ill. App. filed April 8, 1927.

1,704,350. ELECTRICAL CONNECTER; H. L. Stanton, Wilkinsburg, Pa. App. filed Feb. 16, 1926.

1,704,362. VERTICAL-TURBINE-PUMP HEAD; C. E. Johnson, Los Angeles, Calif. App. filed July 16, 1925.

1,704,370. THERMOSTAT; L. A. M. Phelan, Beloit, Wis. App. filed Sept. 22, 1924.

1,704,371. ELECTRIC SWITCH; L. A. M. Phelan, Beloit, Wis. App. filed Sept. 22, 1924.

1,704,378. ELECTRIC-CIRCUIT CONTROLLER; B. N. Winegarden, Pittsburgh, Pa. App. filed June 23, 1927.

1,704,379. ELECTRICAL CIRCUIT BREAKER OR INTERRUPTER; E. Aichele, Irvington, N. J. App. filed April 16, 1925.

1,704,389. MESSENGER CALL BOX; G. W. Janson, Nutley, N. J. App. filed Aug. 20, 1926.

1,704,401. ELECTRIC SWITCH; E. F. Miner, Litchfield, Conn. App. filed April 18, 1923.

1,704,404. CIRCUIT-CONTROLLING DEVICE; H. C. Parker, Philadelphia, Pa. App. filed April 20, 1925.

1,704,406. THERMOSTATIC SWITCH; C. T. Penton, Buffalo, N. Y. App. filed Dec. 6, 1923.

1,704,413. APPARATUS FOR HEATING CURVED SURFACES; J. F. Wait, New York, N. Y. App. filed Jan. 17, 1925.

1,704,448. MULTIPLE MAGNETIC CHUCK; H. E. Tracy, Worcester, Mass. App. filed Aug. 15, 1927.

1,704,459. ELECTRIC TIME SWITCH; L. E. Chance, St. Louis, Mo. App. filed June 24, 1926.

1,704,461. SIGN-FLASHER SWITCH; L. E. Chance, St. Louis, Mo. App. filed Dec. 21, 1926.

1,704,463. DEHYDRATOR FOR PETROLEUM EMULSIONS; J. H. C. de Brey, The Hague, Netherlands. App. filed July 20, 1926.

1,704,479. ELECTRIC AIR HEATER; A. J. Kercher, Berkeley, and W. W. Hicks, San Francisco, Calif. App. filed Oct. 3, 1925.

1,704,520. POWER-DEMAND REGULATOR; W. H. Sommer, Peoria, Ill. App. filed May 14, 1927.

1,704,526. PRODUCTION OF WELDED WIRE FABRIC AND APPARATUS THEREFOR; A. Armstrong, Whitley Bay, England. App. filed Sept. 24, 1926.

1,704,568. ELECTRIC SWITCH; W. H. Harrington, Hartford, Conn. App. filed Aug. 26, 1924.

1,704,589. ROTATING FIELD MAGNET FOR TURBO-GENERATORS; O. T. Bláthy, Budapest, Hungary. App. filed Jan. 14, 1927.

1,704,603. CONDUCTOR; S. S. Hartley, Moundsville, W. Va. App. filed June 16, 1928.

1,704,625. ELECTRIC SWITCH; A. H. Nero, West Hartford, Conn. App. filed March 30, 1925.

1,704,627. AUTOMATIC SWITCH-OPERATING MECHANISM; C. M. Osterheld, Stoughton, Wis. App. filed May 11, 1922.

1,704,679. UNIDIRECTIONAL-CURRENT-CARRYING DEVICE; L. O. Grondahl, Pittsburgh, Pa. App. filed Jan. 7, 1925.

(Issued March 12, 1929)

17,235 (reissue). SHEATH CONNECTION IN ELECTRIC-CABLE SYSTEMS; W. B. Kirke, Bronxville, and H. R. Searing, New York, N. Y. App. filed June 23, 1923.

1,704,696. SIGNAL BOX; R. W. Carnahan, Cleveland, Ohio. App. filed Nov. 10, 1922.

1,704,697. COMBINATION FIRE AND POLICE ALARM AND TELEPHONE CALL BOX; R. W. Carnahan, Cleveland, Ohio. App. filed May 19, 1923.

1,704,701. LIGHTNING ARRESTER; E. A. Ermold Philadelphia, Pa. App. filed Nov. 20, 1925.

1,704,726. HEATER PLUG; E. Clemence, New York, N. Y. App. filed Aug. 12, 1926.

1,704,734. MANUFACTURE OF ELECTRICAL RECTIFIERS; P. H. Geiger, Wilkinsburg, and W. S. Brown, Swissvale, Pa. App. filed Aug. 26, 1926.

1,704,736. RAILWAY-TRAFFIC-CONTROLLING APPARATUS AND ELECTRICAL APPARATUS SUITABLE FOR USE THEREIN; P. H. Geiger, Swissvale, Pa. App. filed Oct. 29, 1923.

1,704,761. TANK-LEVEL SIGNAL; E. E. Plant, San Francisco Calif. App. filed Feb. 8, 1928.

1,704,763. ELECTRIC IGNITER; W. J. Robb, Milwaukee, Wis. App. filed March 20, 1926.

1,704,775. RHEOSTAT; W. E. Thorn, Bridgeport, Conn. App. filed Dec. 19, 1924.

1,704,783. ELECTROMAGNETIC CHUCK; J. Bing, Eisenach, Germany. App. filed July 14, 1927.

1,704,821. DISPLAY FIXTURE; C. L. Brown, Peoria, Ill. App. filed July 23, 1926.

1,704,828. SYNCHRONOUS MOTOR; V. A. Fynn, St. Louis, Mo. App. filed June 12, 1926.

1,704,846. METHOD OF AND APPARATUS FOR ELECTRICALLY WELDING PIPE COUPLINGS IN A CONTINUOUS OPERATION; T. Stresau, Wauwatosa, Wis. App. filed Sept. 1, 1923.

1,704,849. PORTABLE TOOL AND CONDUCTOR; C. S. Weyandt, Pittsburgh, Pa. App. filed Dec. 26 1925.

1,704,865. AFTER-HOUR DEPOSITORY; O. B. McClintock, E. G. Lawrence, E. C. Hanson and J. Soderholm, Minneapolis, Minn. App. filed Aug. 12, 1927.

1,704,904. TWO-FLAME ARC LAMP; E. J. Schaub, Maspeth, N. Y. App. filed Aug. 14, 1920.

New Trade Literature

SWITCHES AND GEARS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing circular No. 1821 describing its type W instrument, control and auxiliary switches. The circular contains numerous illustrations and diagrams. The company also has issued publication D.M.F. 5128, entitled "A Triumph of Mechanical Engineering," which gives the history of reduction gears for marine engines.

SWITCHING EQUIPMENT.—The James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis, is distributing bulletin No. 312 which describes and illustrates its outdoor type switching equipment. This bulletin supersedes all previous issues on switching equipment and contains complete engineering data, descriptive information, list and quantity prices of the Kearney outdoor type standard and rural line 7,500-12,000- and 15,000-volt switching equipment.

CONTROL VALVES.—Catalog No. 2000 issued by the Bristol Company Waterbury, Conn., describes and illustrates the Bristol motor-operated and magnet types automatic electric control valves. A price sheet for use with the catalog also has been issued by the company.

ELECTRIC COOKING EQUIPMENT.—The Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, has issued catalog H-70 which describes the Edison electric cooking equipment for hotels, restaurants, bakeries, hospitals, public institutions, marine galleys and clubs. Complete specifications and illustrations of each unit are included and accompanying the catalog are retail, wholesale and minimum net price lists covering the equipment.

LIGHTNING ARRESTERS.—"Effective Lightning Protection" is the title of circular C.1737-D issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This circular gives complete information on the nature and magnitude of transient voltages on electrical systems, lightning arrester requirements and applications. It also contains information on oscillograph studies of lightning phenomena and the economic value of lightning protection and installation views of autovalve lightning arresters, actual oscillograms taken by the cathode ray oscillograph and valuable charts.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Lima Peru (No. 37,102), for electric advertising apparatus and commercial lighting fixtures.

An agency is desired in Berlin, Germany (No. 37,122), for electromedical apparatus, another (No. 37,120) for electromedical apparatus including X-ray lamps, another (No. 37,121), for electromedical apparatus including X-ray lamps and another (No. 37,049), for electrical paint-spraying equipment.

An agency is desired in Winnipeg, Canada (No. 37,119), for electric fans and ventilators, another (No. 37,118), for electric fireplace grates, and small household electrical appliances and another (No. 37,114), for small household electrical appliances such as toasters and hot plates.

An agency is desired in Warsaw, Poland (No. 37,123), for electric floor-scraping machines and household electrical appliances.

A sole agency is desired in Toronto, Canada (No. 37,117), for all types of fuses.

Purchase is desired in Johannesburg, South Africa (No. 37,128), of electrical hotel appliances and lighting fixtures.

Purchase is desired in Quebec, Canada (No. 37,113), of lighting fixtures and wiring supplies.

An agency is desired in Toronto, Canada (No. 37,115), for electric elapsed-time recorders and stamps.